

Direct Examination - Hayne

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1 BY THE COURT: -- before we proceed. Let's take
2 about a ten-minute recess because I know that may be
3 lengthy.

4 (After a short recess, the following was made of record,
5 to-wit:)

6 BY THE COURT: Who does the State call as your
7 next witness?

8 BY MR. HARPER: We call Dr. Stephen Hayne, Your
9 Honor.

10 BY THE COURT: Dr. Stephen Hayne.

11 STEPHEN HAYNE,
12 having been duly and legally sworn, answered
13 questions on his oath as follows, to-wit:

14 BY THE WITNESS: Good morning, Your Honor.

15 BY MR. HARPER: May I proceed, Your Honor?

16 BY THE COURT: Yes, sir.

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18 BY MR. HARPER:

19 Q. Would you state your name, please, sir.

20 A. Stephen Timothy Hayne, sir.

21 Q. And Dr. Hayne, what is your profession?

22 A. I'm a physician practicing in the fields of
23 anatomic, clinical, and forensic pathology.

24 Q. Okay, sir. And do you currently have a position
25 with the state medical examiner's office?

26 A. I do, sir.

27 Q. And what is that position?

28 A. State pathologist with the Department of Public
29 Safety.

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EXHIBIT

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1 Q. How long have you held that position, Dr. Hayne?

2 A. Approximately seventeen, eighteen years, sir.

3 Q. How long have you been practicing in the area
4 in the field that you are now practicing in?

5 A. Almost thirty years.

6 Q. Dr. Hayne, if you would, tell us your education,
7 experience, and training that qualifies you in that field
8 of forensic pathology.

9 A. I graduated from medical school at Brown
10 University. I did my pathology training at Letterman Army
11 Medical Center at the Presidio at San Francisco.
12 Rotations at different institutions in the San Francisco
13 Bay area. I worked -- I went to two duty stations. First
14 at Fort Levinworth, Kansas, and Munsen Army Hospital
15 down -- Blachfield Army Hospital at Fort Campbell,
16 Kentucky. I worked in the north Alabama area, the Shoals
17 medical laboratory for two years. I worked in Mississippi
18 for going on some seventeen or eighteen years now. I have
19 been affiliated with the medical examiner's office
20 continuously and also work as senior pathologist at Rankin
21 Medical Center. Worked at other hospitals in the Jackson
22 metropolitan area. I also served as the medical director
23 of the laboratory at Madison County Medical Center and
24 also at the renal laboratories in Ridgeland, Mississippi.

25 Q. Okay, sir. And as a forensic pathologist, Dr.
26 Hayne, what do you primarily do? What is your primary
27 field? What does that involve?

28 A. The primary task is to come to conclusions as to
29 the cause and manner of death involving the death of

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1 a human being. That requires most commonly contact with
2 coroners, with other investigative agents. Also
3 performing post mortem examinations or autopsies and
4 attempting to come to conclusions as to cause and manner
5 of death.

6 Q. Okay, sir. And, Doctor, approximately how many
7 autopsies have you performed since you've been practicing
8 as a forensic pathologist?

9 A. I don't keep an exact number but about
10 twenty-five thousand.

11 Q. And obviously a good many of those while you
12 were serving with the state medical examiner's office here
13 in Mississippi?

14 A. Yes, sir.

15 Q. And I'll ask you, have you been qualified to
16 testify in court before?

17 A. Yes, sir.

18 Q. Approximately how many times?

19 A. Twenty-five hundred, maybe three thousand times.

20 Q. Okay, sir. And, in fact, have you been
21 qualified to testify as an expert in the field of forensic
22 pathology right here in this court district and in Adams
23 County before?

24 A. Yes, sir. In this courtroom.

25 Q. How many times roughly? I know it's --

26 A. Ten or fifteen times, sir.

27 BY MR. HARPER: Your Honor, we would tender Dr.
28 Hayne as an expert in the field of forensic
29 pathology.

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1 BY MR. CLARK: We'll accept him, Your Honor.

2 BY THE COURT: Let the record show that the
3 Court will accept the witness, Dr. Steven Timothy
4 Hayne, as an expert in the field of forensic
5 pathology. This Court has accepted this witness
6 numerous times in the past in such field, and the
7 Court finds that by virtue of his education,
8 training, experience, skill, and knowledge, that he
9 is so qualified and will be accepted. Now, again,
10 ladies and gentlemen, because he is accepted as an
11 expert witness, he will be allowed to give opinions
12 within his expertise. All right. Mr. Harper, you
13 may proceed.

14 BY MR. HARPER:

15 Q. Dr. Hayne, I'd like to direct your attention to
16 an autopsy that -- or to the date, specifically February
17 the twenty -- I believe it was the 22nd of this year,
18 2002, and ask if you had occasion to perform an autopsy on
19 that date on a six-month old or approximately six-month-
20 old infant child by the name of Chloe Madison Britt.

21 A. I did, sir. And the --

22 Q. Okay, sir --

23 A. -- autopsy started at 6:50 in the evening. The
24 autopsy was requested by the county coroner medical
25 examiner investigator of this county, the county of
26 jurisdiction. Mr. Lee requested that, and that request
27 was in compliance with the Coroner's Reorganization Act of
28 1986 Amended.

29 Q. Okay, sir. And if you would, Dr. Hayne, just

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1 tell us briefly -- or what an autopsy entails for the jury
2 and for myself. What exactly you're talking about when
3 you're doing an autopsy on someone and what your purpose
4 for doing that is.

5 A. An autopsy or post mortem examination is
6 essentially defined by the term autopsy. Auto ops is, I
7 see, I observe, I look. The primary purpose is to come to
8 a conclusion as to the cause and manner of death. The
9 cause of death being the medical reason an individual
10 died, whether it be from a heart attack or gunshot wound
11 or literally thousands of possibilities. While the manner
12 of death is a classification of that death, whether it be
13 suicide, homicide, accident, natural, some cases pending
14 to additional information is gathered, and in rare cases,
15 undetermined. When one cannot come to a final conclusion.
16 An autopsy is an examination of a body, and the initial
17 step is not actually looking at the body but receiving
18 information concerning the death from the submitting
19 officer, in this case, Mr. Lee. That's followed by an
20 external examination, looking at the external surfaces of
21 the body, and always focusing on any aspect that may be
22 associated with the cause of death and the manner of
23 death. There is collection of evidence appropriate to
24 that step. Photographic documentation. I use body
25 illustration diagram sheets to document, the pieces of
26 paper, the findings that I'm observing, their locations,
27 and extent and size. That's followed by, then, an
28 internal examination, looking at the body organs after
29 opening the body. Looking at the head, looking at the

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1 scalp, looking at the contents of the chest and abdominal
2 cavities to see if there's any evidence of injury or
3 disease at those locations, as well as collecting evidence
4 appropriate to that step of the examination. It's
5 followed after completion of that with a discussion of the
6 case with the submitting officer. Again, in this case,
7 Mr. Lee, county coroner medical examiner investigator.
8 Then a microscopic review of the tissues is performed.
9 Small segments of tissue are removed, and they are
10 reviewed under a microscope, and ultimately, if other
11 information is required, other agencies may be asked to do
12 certain procedures. To assist in the generation of the
13 final document. The cause and manner of death, the two
14 most important aspects of that document, and by the rules
15 of the attorney general of this state, the individual
16 performing a post mortem examination under the coroner's
17 office through the medical examiner's office must generate
18 a written report, must summarize the pertinent findings,
19 and also must come to a conclusion as to the cause of
20 death and the manner of death.

21 Q. Okay, sir. And just to clarify. As I
22 understand what you are saying, Doctor, you examined the
23 body, but your primary focus is to what the cause of death
24 was and in examining it, you pretty much concentrate on
25 that primarily. Would that be safe to say?

26 A. The examination of the body is focused driven.
27 It is essentially to assist an individual in coming to a
28 conclusion as to cause of death and manner of death.

29 Q. You might make ⁴²² observations about the body and

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1 about other things, about other significant things but the
2 most significant thing and what you're looking for is what
3 caused the death?

4 A. Cause of death and then the classification of
5 that death.

6 Q. Okay.

7 A. The medical reason that that individual died as
8 well as the classification of the death into one of six
9 possibilities.

10 Q. Okay, sir. And referring back to the
11 individual, the child, Chloe Madison Britt, did you, in
12 fact, do those things in your autopsy with her?

13 A. I did, sir.

14 Q. Okay. Would you tell us about your autopsy.
15 What you were able to find and what your examination
16 showed you of Chloe Madison Britt.

17 A. On the external examination, there were injuries
18 consisting predominantly of bruises or contusions
19 medically. They were located over the forehead at several
20 sites, measuring up to approximately one inch
21 individually. There was also a bruise located on the back
22 of the scalp, extending to the left, measuring
23 approximately two and one half inches. There was also a
24 bruise located over the nose, measuring approximately one
25 quarter of an inch. There was also a contusion to involve
26 the upper lip that measured approximately one half inch,
27 and there was a tear of the frenulum just inside the
28 mouth. That piece of tissue that attaches the upper part
29 of the lip to the maxilla, the upper ridge that holds the

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1 teeth, and there was a tear that measured approximately
2 one quarter of an inch located just inside the mouth.
3 There was also bruising located over the front surface of
4 the right thigh, measuring approximately one inch, and
5 there was also a bruise located over the front surface of
6 the left thigh that also measured -- or this measured
7 slightly larger, almost an inch and a half at that site.
8 So there were bruises located over the external surface of
9 the body, including the forehead, also the upper lip, the
10 nose, the back of the head, and there was also bruising
11 located to the front surfaces of both the right and the
12 left thighs, sir.

13 Q. Okay, sir. Did you notice anything or did you
14 observe anything concerning the rectum or rectal area?

15 A. I would include that in the internal
16 examination. On the internal examination, examination of
17 the lower gastrointestinal tract revealed the presence of
18 a contusion, measuring approximately one inch, and that
19 was located at approximately the nine o'clock area of the
20 rectum extending to approximately the ten o'clock to
21 eleven o'clock area, sir.

22 Q. You would have done that during your internal
23 examination?

24 A. Yes, sir.

25 BY MR. HARPER: May I approach the witness, Your
26 Honor?

27 BY THE COURT: Yes, sir.

28 (Mr. Harper hands the witness a glass of water.)

29 BY MR. HARPER: **424** May I proceed, Your Honor?

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1 BY THE COURT: Yes, sir.

2 BY MR. SERMOS: Excuse me, Your Honor. One
3 moment. May we move this back just a little bit?

4 BY THE COURT: Absolutely.

5 BY MR. SERMOS: We just can't see.

6 BY MR. HARPER: I am sorry.

7 (Mr. Sermos moves the easel so the defense table can see.)

8 BY MR. HARPER:

9 Q. Dr. Hayne, I am going to hand you what's been
10 marked as State's Exhibit 4 and ask if you'll look at that
11 and tell whether or not that -- I think that photograph
12 may be taken prior to your examination, but is that
13 consistent with what you saw when you made the examination
14 of the child?

15 A. It shows an injury located over the front
16 surface of the left thigh on the decedent, Chloe Britt.
17 That is the injury that I described measuring
18 approximately two inches located over the front surface of
19 the left lower extremity, sir.

20 Q. Okay, sir. I see the right lower extremity is
21 in there. Can you -- are you able to observe the injuries
22 that you noted there?

23 A. There's an injury located over the front surface
24 of the right thigh, and that is slightly smaller,
25 measuring approximately one inch, and it appears to be in
26 view in this photograph, sir.

27 Q. Okay, sir. You mentioned several. I'm going to
28 show you several photographs. Can you identify this
29 photograph, Doctor? It's State's Exhibit 6.

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1 A. State's 6 is a facial view of the decedent, and
2 it specifically shows injuries that I have described,
3 injuries located over the upper lip as well as over the
4 forehead consisting of bruises located at those sites,
5 sir.

6 Q. Is that consistent with what you saw on that
7 date of February 22nd when you did your autopsy?

8 A. Yes, sir. Consistent and also documented.

9 Q. In fact, you took this photograph or it was
10 taken while at your direction; is that right?

11 A. That's correct, sir.

12 Q. I'll hold this one up, Doctor, and ask if you
13 can identify this one.

14 A. Yes, sir. This shows the facial area of the
15 decedent, and specifically it shows the bruises located to
16 the upper lip, sir. And in the very top of it, you can
17 see the bruises located over the forehead.

18 Q. Okay, sir. And, again, this photograph was
19 taken by you or at your direction?

20 A. It was taken by me, sir.

21 Q. And it fairly and accurately represents what you
22 saw on that particular day?

23 A. It does, sir.

24 Q. I hand you what's been marked as State's Exhibit
25 8 and ask if you'll look at that and tell me whether or
26 not you can identify what's in that photograph, please.

27 A. I can, sir.

28 Q. What is that, sir?

29 A. It shows a tear of the frenulum, a piece of

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1 tissue attaching the upper lip to the upper jaw, sir.

2 Q. Okay. And, again, does that fairly and
3 accurately represent the injuries that you saw on that
4 child on the date of February 22, 2002?

5 A. It does, sir.

6 Q. Again, this was taken by you or at your
7 direction at the autopsy.

8 A. Taken by me, sir.

9 Q. Okay. I hand you what's been marked as State's
10 Exhibit 15 and ask if you'll look at that, and tell me
11 whether or not you can identify that photograph. Yes,
12 sir. It is the back of the head of the decedent and upper
13 part of the back of the decedent, sir.

14 Q. And is there anything significant in that
15 photograph that you can see?

16 A. There was a bruise located over the back of the
17 head extending towards the left ear, sir.

18 Q. And, again, this photograph was taken by you and
19 it fairly and accurately represents that injury that you
20 saw?

21 A. Yes, sir.

22 Q. Would you point that one out for us.

23 A. Right there, sir.

24 BY MR. HARPER: Please the Court, Your Honor.

25 I don't think this photograph -- I don't think it's
26 been published to the jury. May I publish it to the
27 jury.

28 BY THE COURT: You'll be allowed to do so.

29 That's number --

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1 BY MR. HARPER: Number 15.

2 BY THE COURT: You will be allowed to publish
3 Exhibit 15 to the jury.

4 (Mr. Harper passes Exhibit 15 to the jury.)

5 BY MR. HARPER:

6 Q. I hand you now what's been marked as State's
7 Exhibit 14 and ask if you'll look at that and tell me
8 whether or not you can identify what's in that photograph?

9 A. Yes, sir.

10 Q. And would you tell us what that one --

11 A. It shows the back of the head of the decedent
12 and upper part of the back and shows a bruise starting in
13 the mid back area going towards the left back of the head,
14 sir.

15 Q. And I'll will hold that one up and ask if you
16 would point this out for us, please?

17 A. A bruise located here.

18 Q. Okay, sir. And that fairly and accurately
19 represents the injury you saw on the child, Chloe Madison
20 Britt, on February 22nd at the time of your autopsy?

21 A. Yes, sir.

22 Q. And you took this photograph also?

23 A. I did, sir.

24 BY MR. HARPER: Again, Your Honor, I don't think
25 this one has been --

26 BY THE COURT: You will be allowed to publish
27 that one to the jury also.

28 (Mr. Harper passes Exhibit 14 to the jury.)

29 BY MR. HARPER:

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1 Q. Finally I would hand you what's been marked as
2 State's Exhibit 5 and ask if you'll look at that
3 photograph and tell me whether or not you can identify
4 what's in that photograph.

5 A. Identify what is in --

6 Q. Yes, sir.

7 A. What it depicts, sir?

8 Q. Yes, sir.

9 A. It depicts the bruise located to the rectum of
10 the decedent, sir. That photograph was taken by me during
11 the course of the post mortem examination.

12 Q. Okay, sir. I'll ask you, Dr. Hayne. What
13 would that be indicative of, the injuries that you saw to
14 the rectal area, if you can answer that question.

15 A. It would be consistent with penetration of the
16 rectum with an object, sir.

17 Q. Okay. Now, I didn't mean to interrupt you, but
18 I thought it might behoove us to go ahead and go through
19 the pictures. So you've testified about your external
20 examination and what you were able to see. What, if
21 anything, did you do after that, Dr. Hayne?

22 A. An internal examination was conducted. The
23 bruise was identified in the rectal area, and of greater
24 importance, I think, was the presence of significant
25 injury to the head area. When the scalp was reflected,
26 there were bruises located over the scalp. There was also
27 as the calvarium or skull cap was removed. There was also
28 a collection of blood located between the skull and the
29 brain itself, and it -- what's called the subdural space,

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1 collection of a volume of approximately thirty CC's which
2 would be several tablespoons of blood located at that
3 site.

4 Q. Would that be normal for that -- for that blood
5 to be in the --

6 A. No. It would indicate injury. It would
7 indicate trauma had occurred.

8 Q. For in laymen's term if you would for me and
9 whoever else might -- would you tell us -- as I understand
10 it, Dr. Hayne, you actually take the skull, open it, and
11 where you can see inside. Would that be correct?

12 A. Yes, sir. Initially you make an incision going
13 over the top of my head -- if I may use my finger --
14 behind each ear. The scalp is moved forward and back
15 exposing the skull cap itself, and located underneath the
16 skin surface of the scalp itself, there were multiple
17 bruises as I indicated. After removal of the skull cap
18 itself, there was a collection of blood between the inner
19 surface of the skull and outer surface of the brain.
20 There are small bridging vessels, small veins that go from
21 the inner surface of the skull to the outer surface of the
22 brain, and when the head is injured, there's transfer of
23 force. The brain usually oscillates back and forth, and
24 it will tear these vessels, and that will allow for the
25 collection of blood in that space, the subdural space,
26 between the inner surface of the skull and the outer
27 surface of the brain. There's also other injury to the
28 brain itself, and that is that surface of the brain had
29 extensive hemorrhage or bleeding over it called a

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1 subarachnoid hemorrhage. So when you actually held the
2 brain in your hand, that blood remained in contact with
3 the brain itself as opposed to the subdural hemorrhage
4 which was left inside the skull itself when the brain was
5 removed. There was also other injury that was
6 identifiable and subsequently confirmed by microscopic
7 examination. That is that the eyes when they were
8 enucleated or removed and sectioned. There was obvious
9 blood in those in the chambers of the eye and the optic
10 nerves that run to the eye from the brain also had
11 hemorrhage that one could readily recognize at the time of
12 the autopsy. The eye is actually part of the brain. It's
13 an extension of the brain. So it's included in the
14 examination of the brain, and there was, I felt,
15 significant -- there was bleeding inside the eyes called
16 retinal hemorrhages as well as bleeding over the surface
17 of the scalp, bleeding between the inner surface of the
18 skull and the brain and also bleeding over the surface of
19 the brain itself.

20 Q. Would you term it incidental bleeding in these
21 areas that you've described or excessive bleeding? How
22 would you term that?

23 A. I consider them lethal.

24 Q. Lethal.

25 A. Lethal. It would produce death, sir.

26 Q. Okay, sir. Now, you have some charts, Dr.

27 Hayne. Did you want to show us anything in regard to
28 these -- what you told us in --

29 A. I think it shows on that one chart the bleeding

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1 over the surface of the brain.

2 Q. Would you --

3 BY MR. HARPER: Your Honor, if it please the
4 Court, we'd ask that he be allowed to come down and
5 show them the charts.

6 BY THE COURT: He'll be allowed to step down if
7 he needs to testify.

8 (Witness steps down.)

9 BY MR. HARPER: Let's move it up where the jury
10 can see it better, if I don't drop it.

11 BY THE COURT: Again, defense counsel and the
12 defendant may move around so that they can see --

13 BY MR. HARPER:

14 Q. Dr. Hayne, before we start, let me just ask you.
15 These diagrams are part and parcel of your autopsy report;
16 is that correct?

17 A. Yes, sir. They're made during the course of the
18 post mortem examination.

19 Q. Okay, sir. And, if you would, what does this
20 particular chart depict?

21 A. They're several different views of the brain,
22 looking down on the top of the brain, looking at the
23 bottom of the brain upward, and looking at the left side
24 of the brain, and also looking at the right side of the
25 brain, and on the illustrations, I added notes essentially
26 indicating by the cross checks that there was extensive
27 bleeding in the subarachnoid space on the surface of the
28 brain itself. That there were no contusions or bruises
29 and no tears of the brain itself. Also indicated that

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1 there were no fractures. They were no breaking of the
2 bones composing of the skull, skull cap, base of the
3 skull, and other bones structures. Also indicated that
4 there was a collection of approximately thirty CC's of
5 blood in the subdural space. That space -- may I draw on
6 this?

7 Q. Yes, sir. Absolutely.

8 A. If you look at the skull, we've opened it. The
9 brain will sit approximately like that, and there was a
10 space between the inner surface of the skull and outer
11 surface of brain. The subdural space and that is the
12 bleeding that I am referring to down here. There's a
13 collection of blood in this space, and in addition, there
14 was bruising eluded to, involved the scalp in several
15 locations. Some of which were visible on the external
16 examination. Bruises located underneath the scalp --

17 Q. Let me interrupt you a second. When you got
18 into the internal examination, you found more bruising
19 than what you were able to see from the external --

20 A. Yes, sir.

21 Q. -- examination by eye.

22 A. That's correct, sir. And then on the surface
23 of the brain itself were the areas of bleeding, the
24 subarachnoid hemorrhage, and if one looks at the optic
25 tracts, part of the cranial nerves that go to the eye.
26 There was also bleeding around those structures, and when
27 one examined the eye itself and a cross section of it, the
28 several layers of the retina and they were bleeding in
29 multiple layers of the retina, inside of the eye itself,

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1 and extending to the optic nerve which runs back to the
2 brain.

3 Q. Okay, sir. All right. Thank you, Doctor. You
4 indicated earlier that what you observed there would be
5 lethal. Were you able to come to a conclusion as to cause
6 of death in this particular case?

7 A. Yes, sir.

8 Q. What was that?

9 A. It was consistent with the shaken baby syndrome,
10 sir.

11 Q. And would you tell the jury what you mean by
12 that, and if want to have a seat or if you want to use
13 your diagrams.

14 BY MR. HARPER: If the Court, please, Your
15 Honor. I ask that he be free to get up and come to
16 the charts if he needs to, to show something.

17 BY THE COURT: He'll have that option if he so
18 desires.

19 A. It would be consistent with a person violently
20 shaking a small child. Not an incidental movement of a
21 child, but violently shaking the child back and forth to
22 produce the types of injuries that are described as shaken
23 baby syndrome, which is a syndrome known for at least
24 forty-five years now. Coined by a Dr. Coffee who analyzed
25 several of these in Denver, Colorado, and the classic
26 triad for shaken baby syndrome is one, the presence of a
27 subdural hemorrhage; and, two, the presence of retinal
28 hemorrhage; and, three, the absence of other potentially
29 lethal causes of death. Other etiologies or causes of

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1 death. So it's inclusionary and exclusionary. Both
2 inclusionary findings were present. The subdural
3 hemorrhage, the retinal hemorrhage, and also there was an
4 exclusionary competent. I did not find any other cause of
5 death, sir.

6 Q. You indicated that it would require what you
7 call violent shaking, and I know somewhat demonstrated.
8 How violent are we talking about, Dr. Hayne? I mean, is
9 this something --

10 A. The type of injuries that you can see that
11 parallel these are in motor vehicle crashes, falls from
12 significant heights and the like, sir.

13 Q. So we're talking about violent shaking?

14 A. We're talking about very violent shaking.

15 Q. Okay. And that was your determination as to
16 cause of death?

17 A. Yes, sir.

18 Q. Okay, sir. And did you make a determination as
19 to manner of death?

20 A. Yes, sir.

21 Q. And what was that?

22 A. I thought it was consistent with homicide, sir.

23 Q. Obviously the child was six months old. Could
24 she do this to herself?

25 A. No, sir.

26 Q. Okay. It would have to be someone else that did
27 it?

28 A. It was another person, sir.

29 Q. Violently shaken.

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1 A. Violently shaking, producing these injuries
2 and, of course, there were other injuries that were
3 identified on the body, but were not participatory in the
4 death of the child.

5 Q. And, again, this is what your concentration on
6 is what caused the death. So I would assume that your
7 examination, although thorough, was on the head injuries?

8 A. Yes, sir. As opposed to a clinical physician
9 who is treating an individual who obviously is alive or
10 has a potential of being resuscitated, and that, of
11 course, focuses different than a person like me who I am
12 looking at the cause and manner of death, sir.

13 Q. Okay, sir. Now, Dr. Hayne, after you had
14 completed -- or if you would, just go on. You did your
15 internal examination. I believe you talked about some
16 microscopic -- you completed the complete examination as
17 you described to us earlier that you had performed.

18 A. Yes, sir.

19 Q. Okay, sir. What, if anything, else did you do
20 or if you would tell us anything of significance that you
21 were able to find during the course of your examination
22 other than what you've already described.

23 A. The other significant findings were the
24 collection of evidence.

25 Q. Okay, sir.

26 A. Photograph documentation, evidence that was
27 submitted to the Mississippi State Crime Lab.

28 Q. Okay, sir. Would that include the extraction of
29 blood from the victim?

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1 A. Yes, sir. There were several tubes of blood
2 extracted, removed, phlebotomized for different reasons.
3 Toxicology, DNA, serology, and the like, sir.

4 Q. And those were transported -- transferred to the
5 crime lab --

6 A. Yes, sir.

7 Q. -- delivered to them?

8 A. Under the chain of custody.

9 Q. Yes, sir.

10 BY MR. HARPER: The Court will indulge me just
11 one moment, Your Honor.

12 (Mr. Harper and Mr. Rosenblatt confer.)

13 BY MR. HARPER:

14 Q. Dr. Hayne, getting back to your photographs, you
15 talked about the injury to the mouth and the frenulum, I
16 believe you called it?

17 A. Yes, sir.

18 Q. What would that be indicative of to you?

19 A. It could be insertion of an object in the mouth,
20 pulling of the lip, even pushing down on the upper part of
21 the jaw to produce that.

22 Q. Could be consistent with insertion --

23 A. It could be.

24 Q. Penetration?

25 A. Yes, sir.

26 BY MR. HARPER: The Court will indulge me one
27 more --

28 (Mr. Harper and Mr. Rosenblatt confer.)

29 BY MR. HARPER: Your Honor, I believe that's all

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1 I would have, and we tender Dr. Hayne at this time.

2 BY THE COURT: Cross-examination.

3 BY MR. SERMOS: One moment, please, Your Honor.

4 (Mr. Sermos and Mr. Clark confer.)

5 CROSS-EXAMINATION

6 BY MR. SERMOS:

7 Q. Dr. Hayne, as far as your examination and I
8 don't want to even try to put words in your mouth, but,
9 essentially, the shaken baby syndrome here and the cause
10 of death and then the manner of death, those two things,
11 especially the shaken baby syndrome, that is a totally
12 separate item from any allegations or indications of
13 rectal or sexual abuse; is that correct?

14 A. The cause of -- yes. The cause of death that I
15 addressed was the shaken baby syndrome. The manner of
16 death, of course, is a product of the cause of death. The
17 other findings were separate, sir. They did not
18 constitute lethal injuries that would produce death in and
19 of themselves, sir.

20 Q. And then the next question is when you use the
21 word in your report "contusion" -- excuse me one moment,
22 please, and I'll get right to. You had used the word in
23 the rectum there would have been a contusion. In your
24 definition from a medical expert standpoint, is a
25 contusion and a tear the same thing?

26 A. No, sir.

27 Q. Okay. Would you please tell the jury what the
28 difference would be?

29 A. A tear is a laceration most commonly whether

Cross-Examination - Hayne

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1 it's a complete, full thickness disruption of the -- in
2 this case, the mucosal surface as opposed to a skin
3 surface. A contusion is a collection of blood underneath
4 the mucosal surface.

5 Q. Okay.

6 A. It's a product of tearing of vessels underneath
7 the skin or mucosal surface and bleeding at that site with
8 the subsequent collection of blood.

9 Q. So that could be caused by something different
10 than would cause a tear; is that correct?

11 A. Could be, or it could be the same object.

12 Q. If there were any tears down there in your
13 report when you put a contusion of the anus is noted, I
14 presume you would have also written tears were noticed
15 also; is that correct?

16 A. If I had seen them, I would put down
17 laceration. I did not see it in this case, and I did not
18 exclude it, but I just didn't see it.

19 Q. The next part of that is you mentioned in your
20 report on -- actually it's page two after your cover
21 sheet. You put well-formed stool is present within the
22 luminal space of the large bowel.

23 A. Yes, sir.

24 Q. Is the large bowel by what you're referring to
25 here, the descending colon?

26 A. It would include the descending colon, yes.

27 Q. Okay. So where the next question comes from is
28 this. At the time the baby was deceased, was in the
29 hospital, the other witness have testified that there was

Cross-Examination - Hayne

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1 feces coming out of the baby's anus and rectal area, and
2 that it was basically diarrhea type. Now, is there a
3 difference in diarrhea and well-formed stool?

4 A. Yes, sir.

5 Q. Okay. My next question would then be what would
6 cause -- if these witnesses testified to this that there
7 was diarrhea, loose bowels, and basically this was at the
8 time of death. When would the well-form stool form? Was
9 it already there?

10 A. I think the well-formed stool is already
11 present, and that would include the ascending as well as
12 transverse colon. Now, if there was injury to a lower
13 part of the colon that could be a transfer of fluid in
14 that site, and you can get a semi-liquid stool while you
15 have solid stool in the first part of the colon.

16 Q. Okay. And then that would go to the next part
17 of what you probably would have done -- it's not in your
18 report anywhere, and I don't presume it existed, but had
19 there been some damage into or of the descending colon,
20 you would have noticed that; is that correct?

21 A. I would have, sir.

22 Q. And when you stated that around the rectum or
23 the anular ring -- someone has talked about the anus or
24 the anular ring, the sphincter. That there was that
25 contusion there, and that could be caused -- I believe you
26 said by an object?

27 A. Yes.

28 Q. If an object had -- when you state that, the
29 object merely has to come into contact with the anus and

Redirect Examination - Hayne

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1 it doesn't necessarily imply any massive insertion, does
2 it?

3 A. No. It implies force.

4 Q. Right.

5 A. It implies injury to the mucosal surface
6 subsequently tearing the small vessels underneath the
7 mucosal surface.

8 Q. Okay. And then, shall we say, and I'll ask you
9 for your expert opinion on this also. If some object were
10 to have been inserted in that child's anus and even gone
11 into the descending colon or the rectal area and that
12 object were found, then that object should have either
13 some form of tissue, matter, blood, or feces on it.
14 Wouldn't you expect that?

15 A. I would expect to at least see fecal material
16 on it, sir. Maybe other items.

17 Q. Okay.

18 BY MR. SERMOS: One moment, please, Your Honor.

19 BY THE COURT: Certainly.

20 (Mr. Sermos and Mr. Clark confer.)

21 BY MR. SERMOS: We have no further questions,
22 Your Honor.

23 BY THE COURT: All right.

24 BY MR. HARPER: Just a few questions, Your
25 Honor.

26 BY THE COURT: Redirect.

27 REDIRECT EXAMINATION

28 BY MR. HARPER:

29 Q. Dr. Hayne, your examination, I believe you said,

Redirect Examination - Hayne

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1 was done roughly six o'clock on the 22nd?

2 A. Yes, sir. It was almost seven o'clock, sir.

3 Q. Okay, sir. Which my understanding that the
4 child came to the hospital was about 9:40 on the night
5 before. So it was about twenty-two hours or something to
6 that effect by the time you did your examination?

7 BY MR. SERMOS: Your Honor, we object to this
8 line of questioning. The State had the opportunity
9 to review this with the State's witness on direct.

10 BY MR. HARPER: Your Honor, they've asked some
11 questions. I think -- I am trying to lay some
12 predicate to ask some questions consistent with --

13 BY THE COURT: All right. Keep in mind your
14 redirect will be limited to matters brought out on
15 cross-examination.

16 BY MR. HARPER: I understand, sir.

17 BY MR. HARPER:

18 Q. My question to you, Dr. Hayne, with that length
19 of time, would some form of rigor mortis have set in on
20 this child at that point?

21 A. Yes, sir. The child was in full rigors, very
22 stiff.

23 Q. How could that affect, if at all, the rectal
24 area as far as how tight it was or loose, or could it
25 affect that?

26 A. It would contract it, sir.

27 Q. Okay.

28 A. But make the luminal diameter, the actual
29 diameter of the rectum smaller, sir.

Redirect Examination - Hayne

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1 Q. And if there were a tear in that -- a slight
2 tear or whatever, as it contracted, could be less visible
3 and, in fact, almost appear to be a contusion at that
4 point if it contracts to that extent. Would that be a
5 safe statement?

6 A. I think the contusions would remain. The small
7 tear, after we washed the body and after rigor has already
8 set up, we may not see that, sir.

9 Q. And as you stated before, your examination is
10 primarily concerned with the injuries that caused the
11 death; is that right?

12 A. Yes, sir.

13 Q. You would have observed other injuries but --

14 BY MR. SERMOS: Objection, Your Honor. He's
15 going on the things he already asked him when he
16 first started direct.

17 BY THE COURT: I'll sustain that last question.

18 BY MR. HARPER:

19 Q. Would it be safe to say that the doctor
20 examining the child at the hospital would have looked at
21 that injury more closely than you did?

22 A. They would have looked at it under different
23 circumstances. I think we would look at it very
24 carefully, too.

25 Q. I understand.

26 A. But I think there would be alterations in the
27 body that we would see that they would not see.

28 Q. Or that they might see that you could not see.

29 A. That's correct, sir.

JURY OUT

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1 Q. Thank you, sir.

2 BY MR. HARPER: That's all I have, Your Honor.

3 BY THE COURT: You may step down.

4 BY THE WITNESS: Thank you, Your Honor.

5 (The witness steps down.)

6 BY MR. HARPER: Your Honor, we'd ask that Dr.

7 Hayne be released.

8 BY THE COURT: You'll be released.

9 BY MR. HARPER: Oh, Your Honor, I am sorry.

10 BY THE COURT: Okay. Who does the State call as
11 your next witness?

12 BY MR. HARPER: The Court indulge us just a
13 moment.

14 (Mr. Harper and Mr. Rosenblatt confer.)

15 BY MR. HARPER: Your Honor, at this time, the
16 People of the State of Mississippi would rest our
17 case.

18 BY THE COURT: Okay. Ladies and gentlemen, the
19 State has rested. The case has been moving along
20 quite satisfactorily. It's going to be necessary to
21 take a short recess at this time. So this will be
22 about a fifteen-minute recess. If you will, use the
23 facilities down at the end of the hall. Keep in mind
24 what I said about no contact with anybody involved in
25 this case, and I'm going to need to see counsel and
26 the court reporter in the jury room. So this will be
27 about a fifteen-minute recess.

28 (The following was heard in the chambers of the Judge,

29 OUTSIDE THE PRESENCE OF THE JURY, to-wit:)

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Deposition of Dr. Steven Hayne

1

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF MISSISSIPPI
WESTERN DIVISION

JEFFREY HAVARD

PETITIONER

VS.

CIVIL ACTION NO. 5:08-CV-275-KS

CHRISTOPHER EPPS, et al.

RESPONDENTS

DEPOSITION OF DR. STEVEN HAYNE

Taken at the offices of
Watkins & Eager,
400 East Capitol Street,
Jackson, Mississippi,
on Tuesday, November 23, 2010,
beginning at approximately 8:57 a.m.

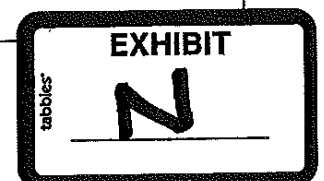
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Deposition of Dr. Steven Hayne

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Deposition of Dr. Steven Hayne

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Deposition of Dr. Steven Hayne

4

1 MR. MAGEE: Good morning. This is the
2 videotaped deposition of Dr. Steven Hayne taken by
3 counsel in the matter of Jeffrey Havard versus
4 Christopher Epps, et al., in the District Court of the
5 Southern District of Mississippi, Western Division.
6 Today's date is November 23rd, 2010. The time is
7 approximately 8:57 a.m. Counsel may now introduce
8 themselves on record.

9 MR. JICKA: I am Mark Jicka, and I represent
10 Jeffrey Havard.

11 MR. CARNER: Graham Carner, also for
12 Mr. Havard.

13 MR. McNAMARA: Pat McNamara representing the
14 Attorney General and Christopher Epps.

15 MR. MAGEE: The court reporter may now swear
16 in the witness.

17 (Witness sworn.)

18 THE WITNESS: I'll waive and may I have a
19 copy?

20 DR. STEVEN HAYNE,
21 having been duly sworn, was examined and testified as
22 follows:

23 EXAMINATION

24 BY MR. JICKA:

25 Q. Good morning, Dr. Hayne.

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Deposition of Dr. Steven Hayne

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1 A. Good morning, Counselor.

2 Q. I'm going to ask you some questions today,
3 and if you don't understand my questions, will you
4 please let me know that?

5 A. I will do that, sir.

6 Q. And I will probably butcher some of these
7 terminologies and pronunciations. So if you'll help
8 me, if I say it in the wrong way, you're certainly
9 welcome to correct my pronunciations.

10 A. Thank you, Counselor.

11 Q. Will you please provide the Court with your
12 professional qualifications, sir?

13 A. I'm a pathologist. I work in the fields of
14 anatomic, clinical, and forensic pathology. I've
15 worked in the field for some 35 years. I'm certified
16 in anatomic pathology, clinical pathology, forensic
17 pathology, forensic medicine, forensic physician.
18 I've worked in the state of Mississippi for some 20
19 years in different capacities in relationship to
20 medical-legal investigation of death, including acting
21 State Medical Examiner, designated State Pathologist,
22 and Chief State Pathologist.

23 Q. And tell me a little bit about your
24 education, sir.

25 A. I did the predominant of my undergraduate

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Deposition of Dr. Steven Hayne

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1 work at North Dakota State, spent two years at the
2 University of North Dakota School of Medicine, and
3 transferred to Brown University in Providence, Rhode
4 Island, where I completed my medical degree, and then
5 I went to San Francisco at Letterman Army Medical
6 Center, where I trained in pathology. I rotated at
7 numerous institutions in the San Francisco Bay area,
8 including Children's Hospital, University of
9 California Moffitt Hospital, Union Memorial Blood
10 Bank, the Medical Examiner's Office for the City and
11 County of San Francisco, as well as others, and then
12 the last six months, I spent in nuclear medicine.

13 Q. Can you list for the Court your
14 qualifications in the area of child sexual abuse
15 investigation and diagnosis?

16 A. It's part of the field of forensic
17 pathology. I've also authored in the field. I wrote
18 a paper with Dr. Hammer, also a resident at the time,
19 at -- stationed at the Presidio with Letterman Army
20 Medical Center, in conjunction with my chief, Colonel
21 Starkey, and the Chief of OBGYN, Colonel Ansbacher.
22 We published that. It was a requirement for
23 graduation of a residency program that you submit and
24 have accepted a paper for publication. So Dr. Hammer
25 and I were pretty good friends, so we co-authored that

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Deposition of Dr. Steven Hayne

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1 paper, and published it. And it was basically
2 identification, collection of evidence, treatment, and
3 the like. It was a comprehensive paper, and it had a
4 long checklist, so it could be posted in an emergency
5 room somewhere, you can go right down the list. And
6 also, when I was in the military, not by choice, but I
7 had to do a lot of sexual assault work-ups in the
8 United States Disciplinary Barracks at Fort
9 Leavenworth, which, as you know, homosexuality in a
10 military institution like that is a major offense
11 under the Uniform Code of Military Justice. So I had
12 to go in night after night and do that work. And many
13 times we have had cases of sexual assault involving
14 death of a human being that we've done medical-legal
15 postmortem examinations on.

16 Q. Have you been accepted as an expert in this
17 field in courts?

18 A. Yes, sir.

19 MR. JICKA: Pat, I know the procedure here is
20 a little different than a typical case, and I don't
21 know if you would have any objection, but -- and I
22 don't know if you have any questions, but we would
23 tender him as an expert witness.

24 MR. McNAMARA: He's already been accepted as
25 an expert in this case.

Deposition of Dr. Steven Hayne

8

1 MR. JICKA: Okay. And I would agree with you
2 on that.

3 BY MR. JICKA:

4 Q. Dr. Hayne, you performed an autopsy on Chloe
5 Britt; is that correct?

6 A. Yes, Counselor. You pronounce it Chole
7 Britt.

8 Q. I think it's Chloe.

9 A. Chloe?

10 Q. But I'm not sure.

11 A. Because it is an Hispanic name. It would be
12 Chole (sic) if it was in Spanish. Maybe it would be
13 Chole.

14 Q. Why don't we call her Miss Britt? And that
15 was part of your duties in your profession; is that
16 correct?

17 A. That's correct. Now, on that date of 2002,
18 actually, it was the 22nd of February when the
19 postmortem examination was conducted.

20 Q. And do you have a copy, Dr. Hayne, of your
21 final report of autopsy with you today, sir?

22 A. I do, Counselor.

23 MR. JICKA: Okay. And, Pat, I'm going to
24 mark that final report of autopsy as an exhibit to his
25 deposition.

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Deposition of Dr. Steven Hayne

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1 (Exhibit 1 marked.)

2 BY MR. JICKA:

3 Q. Dr. Hayne, what was the purpose for you doing
4 an autopsy on Miss Britt?

5 A. It was to come to conclusions as to cause and
6 manner of death, cause of death being the medical
7 reason Miss Britt died, and the manner of death is the
8 classification of the death. And one has to come to a
9 conclusion, if it's suicide, accident, homicide,
10 natural, pending, or undetermined. Of course,
11 sometimes, cause of death, one cannot come to a
12 conclusion.

13 Q. Okay. And were you asked to do that by the
14 coroner of Adams County, sir?

15 A. The county coroner, medical examiner,
16 investigator is his official title, and it was James
17 Lee.

18 Q. And as part of his request for you to do an
19 autopsy on Miss Britt, was there documentation or a
20 permit that was issued to you by the Adams County
21 Coroner?

22 A. Yes, Counselor, there's a State form called a
23 ME-1, Medical Examiner 1 form, and that I made part of
24 the postmortem examination as a routine practice of
25 business.

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Deposition of Dr. Steven Hayne

10,

1 MR. JICKA: And I'm going to mark that, Pat,
2 as Exhibit 2, the permit from the Coroner of Adams
3 County.

4 (Exhibit 2 marked.)

5 BY MR. JICKA:

6 Q. What is the purpose when you receive this
7 permit, as you use it in your work?

8 A. Well, it's the request from the County in
9 writing to perform a medical-legal or forensic autopsy
10 the remains so identified on the paperwork, the ME-1
11 -- or ME-17 form.

12 Q. And on the permit that involves Miss Britt,
13 it lists different circumstances, I believe, for you
14 to, I guess, determine or to look at as you're
15 conducting your autopsy; is that correct?

16 A. That's correct.

17 Q. And one of those I see there is a note about
18 sexual assault. Do you see that located?

19 A. I do.

20 Q. And as part of your autopsy, even from the
21 beginning of the autopsy, was it part of your work to
22 determine whether there could be shown that there was
23 a sexual assault in this case?

24 A. In fact, to come to a conclusion, that -- or
25 not come to a conclusion, final conclusion.

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Deposition of Dr. Steven Hayne

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1 Q. All right. But even from the beginning of
2 your work in this case, you knew that sexual assault
3 was at least an issue, at least in the minds of the
4 coroner and the district attorney, as presented to
5 you?

6 A. Not only from the paperwork, Counselor, but
7 also from telephonic communication from the County
8 Coroner, Medical Examiner, Investigator.

9 Q. You did conduct an autopsy on Miss Britt; is
10 that correct?

11 A. I did, Counselor.

12 Q. And in the report, there's no mention of a
13 sexual battery on this child; is that correct?

14 A. That is correct.

15 Q. And why is that not listed as something in
16 your final report of autopsy?

17 A. I could not come to a final conclusion as to
18 that, Counselor.

19 Q. Okay.

20 A. There was one injury that I indicated would
21 be consistent with the penetration of the anal area,
22 but that, in and of itself, I didn't feel was enough
23 to come to a conclusion that there was a sexual
24 assault in this particular death.

25 Q. Okay. When you did your autopsy, you were

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Deposition of Dr. Steven Hayne

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1 not able to find any tearing of the anal area on this
2 child; is that right?

3 A. No, there was not.

4 Q. If that is something that you had noted or
5 found, then would you have noted it in your report,
6 correct?

7 A. I would have.

8 Q. And you also would have had photographs that
9 would have shown that on this child, correct?

10 A. I would have.

11 Q. All right. And it's mentioned -- sexual
12 assault or battery is not mentioned anywhere in this
13 report; is that correct?

14 A. No, I did not see evidence of that,
15 Counselor. I was asked in court, but I did not see
16 evidence in the autopsy, and, therefore, did not
17 reflect it in the report.

18 Q. You did find a one-centimeter contusion; is
19 that correct?

20 A. That's correct.

21 Q. Just for the record, how big is a
22 one-centimeter contusion?

23 A. Approximately like that, Counselor.

24 Q. Okay. Now, but that was not listed in the
25 list on the autopsy report as a traumatic injury; is

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Deposition of Dr. Steven Hayne

13

1 that correct?

2 A. It wasn't, but it was listed in the body of
3 the report, and also in the illustration body diagram.

4 Q. In other words, you noted it in your report,
5 but did not list it as a traumatic injury to this
6 child?

7 A. That's correct.

8 Q. And is that because there could be many
9 possible alternative causes for a contusion such as
10 this found on this child?

11 A. It's probably a typo error, Counselor,
12 because I'm sure I dictated it, but the typist skipped
13 it.

14 Q. All right. The photographs we mentioned
15 didn't show any tearing; is that correct?

16 A. That is correct.

17 Q. All right. And, further, no tearing was
18 listed or noted in the autopsy report?

19 A. No lacerations or abrasions were identified,
20 only a single contusion.

21 Q. In this case, Dr. Hayne, you had prepared
22 earlier a declaration. Have you had an opportunity to
23 look at that?

24 A. I have.

25 MR. JICKA: I'm going to mark this, Pat, as

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Deposition of Dr. Steven Hayne

14

1 the next numbered exhibit to Dr. Hayne's deposition,
2 which will be Exhibit 3.

3 (Exhibit 3 marked.)

4 BY MR. JICKA:

5 Q. Dr. Hayne, were you able to review this
6 declaration and correct it for any errors prior to
7 executing it on March 5th, 2009?

8 A. Well, sir, I'm looking to see if I can find
9 in my file here what you're addressing.

10 Q. I've got an extra copy.

11 A. Thank you.

12 Q. In this declaration, Dr. Hayne, it, first of
13 all, involves your work and your opinions in the
14 Jeffrey Havard matter, correct?

15 A. That's true.

16 Q. And you state, again, and forgive me, Pat,
17 I'm going to try not to be too redundant on this in
18 this deposition today, but, in there, you state that
19 you found no tears -- this is in paragraph seven,
20 Dr. Hayne.

21 A. Yes, sir.

22 Q. No tears to the rectum, anus, anal sphincter
23 or perineum; is that correct?

24 A. That's correct.

25 Q. And it's not possible that tears would have

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Deposition of Dr. Steven Hayne

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1 healed between the time that Miss Britt was seen in
2 the emergency room and that you performed the autopsy?

3 A. They would not.

4 Q. I want to ask a little bit about this area of
5 the human body. Do you agree that there's a delicate
6 tissue lining of the anus rectum that can be damaged
7 easily in a child of this age?

8 A. It can. It is a squamous mucosa lining, not
9 skin.

10 Q. Okay.

11 A. And that is more easily injured, traumatized,
12 than skin surface.

13 Q. And an injury can occur in a child like this,
14 even by the application of a rectal thermometer; is
15 that correct?

16 A. That could happen, but, Counselor, I think
17 that would be highly unlikely to see an injury of such
18 size as secondary to the placement of a thermometer by
19 medical personnel.

20 Q. Okay. All right. And in reviewing the
21 medical records, did you see where her temperature was
22 taken by rectal thermometer on multiple occasions
23 while she was in the emergency room?

24 A. I did see that, sir.

25 Q. As part of the final autopsy report, there's

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Deposition of Dr. Steven Hayne

16

1 also a mention of a sexual assault kit.

2 A. An RSVK 1111 kit was employed to collect
3 evidence that was subsequently submitted to the
4 Mississippi Crime Lab under chain of custody.

5 Q. And as part of your work here, and as a
6 result of the sexual assault kit, isn't it true that
7 there was no semen found after a serological
8 evaluation conducted on this child?

9 A. Actually, by microscopic examination, but no
10 spermatozoa were identified.

11 Q. Okay. And swabs -- I guess what happens is
12 that you will take swabs from different areas of the
13 child's anatomy; is that correct?

14 A. That's correct.

15 Q. And then you will look under a microscope for
16 any evidence that there might be sperm; is that
17 correct?

18 A. That's correct. We look both oral, anal, and
19 vaginal.

20 Q. And on this, it looks like, from the oral
21 swab, the vaginal, and the rectal swab, that there was
22 no evidence found of spermatozoa; is that correct?

23 A. That's correct. There are additional tests
24 that can be performed, serological tests, and I
25 believe those were performed, too, and they were also

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Deposition of Dr. Steven Hayne

17

1 negative.

2 Q. Okay. And the serological evaluation was
3 done with -- from an oral standpoint, a vulvar
4 standpoint, a vaginal standpoint, and a rectal
5 standpoint; is that --

6 A. I believe that is correct, sir.

7 Q. Dr. Hayne, what are the signs of brain death
8 or lack of brain function in a child like this?

9 A. If you have brain death, first, there would
10 be flaccidness. There would be unconsciousness.
11 There would be muscle relaxation. There would be lack
12 of breathing, unless there was artificial respiration
13 being delivered. Body functions would essentially
14 cease, either at that time or shortly thereafter.
15 Eventually, there would be breakdown in tissue,
16 lysis, purification, and the like.

17 Q. Okay. Reviewing the medical records for
18 Miss Britt, I noted certain things, and I want to just
19 mention and ask if these are signs or could be signs
20 of lack of brain function, some of which you've
21 already mentioned. Dilated pupils, sir?

22 A. That would be.

23 Q. Fixed pupils?

24 A. That would be.

25 Q. Lack of muscle tone?

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Deposition of Dr. Steven Hayne

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1 A. That would be, also.

2 Q. Asystole?

3 A. Asystole?

4 Q. Asystole, thank you.

5 A. Yes. That would be if the heart is no longer
6 functioning. You can have brain death and still have
7 functioning of the heart. Cardiovascular
8 functionality could remain for a period of time, and
9 respiratory could for a period of time, too.

10 MR. McNAMARA: I would have to interject and
11 object at this time based on this is outside the scope
12 of what we're here for as far as the sexual assault
13 goes, without it being tied together as it is, and I
14 would object to the continuing leading of the witness.

15 MR. JICKA: Okay. And I'll -- I will try not
16 to lead. Dr. Hayne has a kind of interesting position
17 in this case, so I'm not sure exactly what witness he
18 would be considered by the Court, but I'll -- I don't
19 mind asking nonleading questions.

20 A. May I interject one part to my -- one last
21 part to my answer?

22 BY MR. JICKA:

23 Q. Sure.

24 A. There are many definitions of death. It
25 could be cardiovascular, respiratory, central nervous

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Deposition of Dr. Steven Hayne

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1 system, somatic, cellular, and they all vary, you
2 know, as to response of an individual.

3 Q. Based upon -- you've reviewed the medical
4 records for Miss Britt in this case; is that correct?

5 A. I have, Counselor.

6 MR. JICKA: I'm going to mark those as
7 Exhibit 4 to your deposition.

8 (Exhibit 4 marked.)

9 BY MR. JICKA:

10 Q. Based upon the information available to you,
11 Dr. Hayne, was Chloe Britt brain dead or lacked brain
12 function at the time that her anal dilation was first
13 noted?

14 A. It was.

15 Q. And this was after she was successfully
16 intubated; is that correct?

17 A. That's correct.

18 Q. And is this an opinion within a reasonable
19 degree of medical certainty, sir?

20 A. As reflected in the medical record, yes.

21 Q. Okay. Do you commonly encounter dilated anal
22 sphincters during a postmortem examination?

23 A. It can occur, but it's not as common as I
24 think people think.

25 Q. Is that a recognized finding in the

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Deposition of Dr. Steven Hayne

20

1 postmortem period?

2 A. It can be, yes.

3 Q. And do children who have died of brain
4 injuries have an increased likelihood of having a
5 dilated anus postmortem?

6 A. It's possible. I think you supplied me with
7 one article from the Orange Journal, '97, "American
8 Journal of Forensic Medicine and Pathology." In that
9 particular article, there were 65 cases of which only
10 a handful were involving children of less than one
11 year of age, and of those --

12 MR. McNAMARA: I object again. This is not
13 relevant to what we're speaking about. This is a
14 general study. This is not the case that we're
15 talking about.

16 BY MR. JICKA:

17 Q. Go ahead, sir.

18 A. And of all those, only one had suffered a
19 traumatic death. In that particular case, the anus
20 was described as slit-like. So in that case, there
21 was no dilatation in a violent death that
22 Dr. Lauridson is referring to in his opinion of 65
23 cases published in the Orange Journal.

24 MR. JICKA: And, Pat, I don't -- certainly
25 I'm not dismissing your objection, but this goes

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Deposition of Dr. Steven Hayne

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1 directly to what we believe to be an issue in this
2 case and allowed by Judge Starrett in his order.

3 BY MR. JICKA:

4 Q. Can resuscitation efforts result in a large
5 amount of gas accumulating in the gastrointestinal
6 tract?

7 A. Ineffective resuscitation, cardiopulmonary
8 resuscitation. I do not believe that was the case in
9 this particular individual, in that there was stool in
10 the large bowel, and that would have effectively
11 blocked the passage of air going down the
12 gastrointestinal tract and dilating the distal part of
13 the GI tract.

14 Q. So can this gas, the air and the amount of
15 pressure on the bowel and colon, facilitate the
16 passage of stool?

17 A. It's possible, yes, ineffective
18 cardiopulmonary resuscitation.

19 Q. And isn't that what they had at the emergency
20 room here, they had an ineffective CPR with this
21 child?

22 A. It would only be my impression. They are
23 medically-trained personnel to deliver cardiopulmonary
24 resuscitation in an adequate manner.

25 Q. But this child was not revived at any point

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Deposition of Dr. Steven Hayne

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1 in time that you reviewed in the medical records?

2 A. No, sir, was not.

3 Q. Okay. If the gas enters into the colon,
4 could that cause distention of the colon, and the
5 rectum, and promote further dilation of the anus?

6 A. If that had occurred, yes sir. I saw no
7 evidence of that occurring, but if -- in a general
8 sense, if gas is pushing stool, it can dilate, pack
9 the stool, enlarging the distal bowel, yes, it could
10 do that.

11 Q. Okay. And could a spontaneous bowel movement
12 also contribute to anal dilation?

13 A. Only if they're very hard stool would I
14 expect to see that, if there's enough pressure with
15 force with the chest or enema, you can -- even in
16 cases of acute appendicitis, in patients that have
17 survived. So that can occur, but that's pushing stool
18 down into the space of the vermiform appendix, but I
19 didn't see evidence of that in this particular case.

20 Q. If Chloe Britt was oxygen deprived for 45
21 minutes to an hour before the anal dilation, is it
22 possible that she was -- was located, is it probable
23 that she lacked brain function?

24 A. Forty-five minutes?

25 Q. Forty-five minutes to an hour?

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Deposition of Dr. Steven Hayne

23

1 A. That would be reasonable that she would have
2 been dead.

3 Q. Okay.

4 A. You can survive for a few minutes with oxygen
5 deprivation, if it's total oxygen deprivation. The
6 brain has a store of glucose and oxygen for
7 approximately 15 to 30 seconds, then unconsciousness
8 will commence, and shortly after that, within two to
9 three minutes, death will intervene.

10 Q. In your autopsy report, Dr. Hayne, you note,
11 several times, congestion. If you'll look -- you see
12 on your finding, sir?

13 A. Yes, sir.

14 Q. Can congestion cause contusions?

15 A. No.

16 Q. Okay. The congestion that you found with
17 Chloe Britt, where was it located?

18 A. It was in the viscera, the major organs.
19 That's not to be unexpected. I don't think this death
20 was an immediate death, and there would be a period of
21 time, an agonal phase of death where the
22 cardiovascular activity would be diminishing, pumping
23 efficiency would also diminish, and blood would have a
24 tendency to pool in the different organs, the lungs,
25 spleen, kidneys, and the like, the liver.

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1 Q. The inner mucosa of rectum, is it sometimes
2 visible after death in an autopsy?

3 A. It could be. It's unusual. You would have
4 to spread the buttocks to look and see that.

5 Q. And what would it look like? Would it have a
6 pink or red coloring to it?

7 A. Usually be a pinkish color, where there would
8 be congestion, usually dependent from the geographic
9 or the gravitational pull of blood downward.

10 Q. And if that inner mucosal lining was observed
11 even by physicians, could it be confused as an anal
12 injury?

13 A. I would think not, Counselor. I can't speak
14 for them, but a contusion is usually fairly-well
15 circumscribed and outlined, while congestion would not
16 be, but I would hate to speak for them.

17 Q. Okay. Flaccid, that's the same as limp; is
18 that correct?

19 A. That's correct.

20 Q. Could a flaccid or limp muscle condition
21 contribute to anal dilation?

22 A. That could, yes.

23 Q. Okay. And a dilated anal sphincter is not,
24 on its own, evidence of anal sexual abuse; is that
25 correct?

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1 A. It is not by itself, no.

2 Q. Okay. To determine that sexual abuse is a
3 probability, you would need additional evidence than
4 just the dilated anus; is this correct?

5 A. I would like to see more evidence as to
6 traumatic injuries, also clinical history, and,
7 hopefully, by laboratory testing.

8 Q. Okay. And we don't have here in your
9 analysis, and your autopsy of Miss Britt, that
10 additional type of evidence; is that correct?

11 A. Do not. I only have a contusion, which is a
12 traumatic injury. We do not have abrasions,
13 lacerations, presence of seminal fluid, spermatozoa,
14 and the like.

15 Q. And, Dr. Hayne, can you say from your autopsy
16 evidence, and from the coroner's inquest, the medical
17 records that you reviewed, the photographs, and the
18 laboratory findings, that this child, Miss Britt, was
19 sexually assaulted?

20 A. I could not come to that final conclusion,
21 Counselor. As I remember in trial testimony, I said
22 that the contusion would be consistent with a sexual
23 abuse, but I couldn't say that there was sexual abuse,
24 and, basically, I deferred to the clinical examination
25 conducted at the hospital.

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Deposition of Dr. Steven Hayne

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1 Q. And so from your standpoint and from your
2 expertise, you cannot say that this child was sexually
3 abused, to a reasonable degree of medical certainty;
4 is that correct?

5 A. I could not now and I could not then, either;
6 at the trial, or when I wrote the report, or discussed
7 the case with the coroner.

8 Q. Okay. Is physical sexual abuse of a child a
9 medical diagnosis?

10 A. Well, there's a component of a medical
11 diagnosis. You're describing also a legal issue, too.

12 Q. Right.

13 A. The diagnosis could come from laboratory
14 testing. It could come from physical exam by a
15 treating physician. It could also come from a
16 pathologist in a case where there's death, also from
17 scene investigation. So it's a combination of things,
18 but it's also a legal, and as you notice, I never used
19 the term, "rape." That is a legal term, not a medical
20 term.

21 Q. Yes, sir. Are you familiar with the
22 expertise of the doctors and nurses that treated this
23 child at the emergency room?

24 A. I'm not.

25 Q. Do you know --

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Deposition of Dr. Steven Hayne

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1 MR. McNAMARA: Object to anything along this
2 line. The doctor has stated he is not familiar with
3 their qualifications. He'd be completely incompetent
4 to answer any questions regarding that.

5 BY MR. JICKA:

6 Q. Do you know what, if any, experience they had
7 ever treating children that had had sexual abuse?

8 A. I don't know that, Counselor.

9 Q. Would you agree that it takes a certain
10 medical expertise to determine whether a child has
11 ever been sexually abused?

12 A. I would agree with that, yes.

13 Q. And in this case, from your work, hired by
14 the State, you could not make a determination that
15 sexual abuse was a probability in this case, correct?

16 A. I could not come to a final conclusion,
17 Counselor. I could only come to the conclusion I so
18 testified in court, that the contusion was consistent
19 with what I've seen in a sexual abuse case. And also,
20 just technically, I was contracted not with the State,
21 but by the County.

22 Q. Thank you.

23 A. Adams County.

24 Q. And I appreciate it. Thank you for
25 correcting that. Dr. Hayne, you testified at Jeffrey

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1 Havard's trial, correct?

2 A. I did, sir.

3 Q. And you were not asked, actually, about
4 sexual battery during that trial, were you, sir?

5 A. Not specifically, no.

6 Q. But you were aware, from even from the
7 coroner's permit, that that was an issue in the case,
8 correct?

9 A. Oh, yes, and I knew before I even stepped on
10 the witness stand that was going to be an issue.

11 Q. Okay. And prior to the trial, you discussed
12 this with the district attorney whether you could say
13 to a reasonable degree of medical certainty or even to
14 a probability that sexual abuse occurred, correct?

15 A. That's correct. But all I could tell the
16 district attorney, prior to trial, was that there was
17 a contusion, and that would be consistent with sexual
18 abuse, but I'd like to see more evidence before I made
19 that next and more significant evaluation and
20 conclusion.

21 Q. Okay. You -- if you had been asked the same
22 questions we -- that I've been asking you today in
23 court about sexual abuse, would you have answered them
24 in the same manner, sir?

25 A. Exact way. I think I at least touched on

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1 some of those, and I have not changed my opinion, and
2 it would make no difference whether defense or
3 prosecution was asking me, the answer would be the
4 same.

5 Q. That leads me to my next question. Did you
6 ever meet with Gus Sermos or Robert Clark,
7 Mr. Havard's attorneys about this case?

8 A. I don't remember that, Counselor, but I --

9 MR. McNAMARA: And I object. This is off the
10 subject, not relevant.

11 BY MR. JICKA:

12 Q. If requested by them, would you have met with
13 the attorneys for Mr. Havard in this case?

14 A. I always honor those requests, either
15 prosecution or defense.

16 Q. And would you have answered their questions
17 in a meeting the same way you have today, if asked?

18 A. If they were asking the same questions, I
19 would respond the same way.

20 Q. Dr. Hayne, you can't say, or can you say,
21 that Chloe Britt was sexually penetrated to a
22 reasonable degree of medical certainty in this case?

23 A. I cannot. All I can say is the injury
24 sustained would be consistent with that, but that's
25 not a definitive diagnosis. And maybe I should

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Deposition of Dr. Steven Hayne

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1 explain.

2 Q. Sure.

3 A. I use a series of qualifiers, with reasonable
4 medical certainty, I can say exclude, suggestive of,
5 may fit, consistent with, and diagnostic of.

6 Q. Okay. Let's go off the record for a second.
7 Let me review my notes and see what else I have.

8 A. Sure.

9 MR. MAGEE: Off the record. The time is
10 9:30.

11 (Recess.)

12 (Exhibit 5 marked.)

13 MR. MAGEE: Back on the record. The time is
14 9:40.

15 BY MR. JICKA:

16 Q. Dr. Hayne, thank you for helping me through
17 this information today. What I'd like to do is show
18 you what I've marked as Exhibit 5, and ask you if you
19 can identify what that document is, sir?

20 A. This is a report from the Mississippi Crime
21 Lab, their facility in Jackson, concerning samples
22 that were collected. This would be -- appears to be
23 from the hospital, including clothing, and then
24 there's also a pillow case, and there's a purple-top
25 tube of blood, and then it discusses the results of

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1 the studies that --

2 MR. McNAMARA: I'll have to object. It
3 sounds like the doctor is not familiar with this
4 document.

5 MR. JICKA: All right.

6 BY MR. JICKA:

7 Q. Go ahead, sir.

8 A. And then remarks that some of the specimens
9 were retained for DNA testing, also on an Eddie
10 Walker. From an Eddie Walker, I should say.

11 Q. And, basically, in Exhibit 5, we have some
12 results from a sexual assault evidence collection kit
13 labeled Jeffrey Havard; is that correct?

14 A. Yes, sir.

15 Q. And in your work, are you familiar what makes
16 up these sexual assault evidence collection kits?

17 A. I am, sir. We use them routinely.

18 Q. And what is that, sir?

19 A. RSVK 1111 kit, that would be for collection
20 of saliva, collection of vaginal in fluid, rectal
21 swabs, vaginal swabs, vulvar swabs, oral swabs, any
22 clothing, hair samples, and the like, also, DNA tube
23 of blood.

24 Q. And in all of the evidence that you had
25 mentioned and that's shown here on Exhibit 5, was

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1 there any evidence or DNA connecting Jeffrey Havard
2 with a sexual abuse of Miss -- of the child, Miss
3 Britt?

4 A. In this particular one, I do not see evidence
5 of that. This is basically clothing and other items
6 involving the defendant and the decedent. This is not
7 the material, that I can determine, that was submitted
8 from the autopsy itself.

9 Q. So this would be additional materials that
10 were tested with -- under the sexual assault evidence
11 kit, in addition to the swabs that you've already
12 testified about; is that correct?

13 A. That's correct. It indicates such items as
14 clothes removed at Natchez Community Hospital.

15 MR. McNAMARA: And for the record, I continue
16 to object. This is not a document that the doctor is
17 familiar with or was generated by the doctor.

18 A. And fitted sheet beside a stove, and a used
19 baby diaper, and items like that, Counselor.

20 BY MR. JICKA:

21 Q. Thank you, sir. All right. That's going to
22 be Exhibit 5. Dr. Hayne, I usually start with this,
23 but I guess I'll end at least your direct examination
24 with this. We had noticed your deposition and asked
25 you to bring anything that you had with you regarding

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1 this matter. What do you have in your possession
2 involving this Jeffrey Havard matter, sir?

3 A. This is the complete file, and I also brought
4 a tape. This the complete file that I have,
5 Counselor.

6 MR. JICKA: Okay. Thank you, sir. All
7 right. I'm going to make Exhibit 6 his notice of the
8 videotaped deposition. All right. We will tender the
9 witness, Pat.

10 (Exhibit 6 marked.)

11 EXAMINATION

12 BY MR. McNAMARA:

13 Q. Doctor, let's start off real quickly and just
14 ask you, is your -- in your opinion, the testimony
15 that you've given today, is it consistent with the
16 testimony that you gave at trial?

17 A. It is, sir.

18 Q. Have you had any change of heart? Would you
19 change your testimony?

20 A. I've seen no new facts to change my
21 testimony, Counselor.

22 Q. Okay. I'll ask -- I have here -- have you
23 seen the pictures you took at the autopsy --

24 A. Not since the trial, sir.

25 Q. -- in review? Okay. I'll pass you these

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1 three -- what I have here is a copy of the three, and
2 we'll ask that that be substituted as an exhibit. And
3 can you identify those pictures or do you recall
4 those? They have your markings on there.

5 A. Yes, Counselor, I do recognize these.

6 (Exhibit 7 marked.)

7 BY MR. McNAMARA:

8 Q. Okay. One question I'd ask, as you see those
9 injuries to the child's anus there, do you find that
10 to be consistent with the insertion of a child's
11 rectal thermometer?

12 A. I did not think that was an insertion injury
13 from a rectal thermometer by medical personnel. I
14 could not exclude it, but I think it was unlikely,
15 Counselor.

16 Q. Okay. That is an abnormal anus, isn't it?

17 A. It is, Counselor.

18 Q. Did you -- to the question of the lack of
19 semen or DNA evidence, is there a requirement that
20 someone else's DNA or semen be present?

21 A. No, sir.

22 Q. They're just cause for penetration, is that
23 correct?

24 A. That's correct, sir. It does not necessarily
25 mean that a penis was the device used to penetrate.

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1 It could be some other object.

2 Q. There are several references throughout the
3 trial, something about 12 o'clock, there was an injury
4 at 12 o'clock of the anal area?

5 A. Yes, Counselor.

6 Q. Where exactly is 12 o'clock on that?

7 A. May I point, Counselor?

8 Q. That would be at the top, where --

9 A. Yes, Counselor.

10 Q. -- there's sort of a slender -- it's round in
11 one area, and then it goes up and it's sort of
12 slender?

13 A. That's correct, sir.

14 Q. Is that normal for a child to have that --
15 that wouldn't be a tear, that would just be -- what
16 would that be?

17 A. For what?

18 Q. I'm sorry. The -- at 12 o'clock, it shows --
19 the pictures you're holding, there is a picture of the
20 baby's anus?

21 A. That's correct.

22 Q. And it's rounded; is that correct?

23 A. It's elliptical.

24 Q. Well, toward the top of that 12 o'clock area,
25 does it -- it peaks, it goes up, and comes to a point;

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Deposition of Dr. Steven Hayne

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1 is that -- that's how I'm looking at it.

2 A. Yeah, it points towards the perineum, yes.

3 Q. Is that indicative of that's not a tear, that
4 would be just a stretch?

5 A. I did not see a tear, Counselor, no.

6 Q. What is that indicative of, that 12 o'clock
7 injury?

8 A. There was dilatation at that site, Counselor.

9 Q. Okay. But it was dilatation of the entire
10 anus, correct?

11 A. Yes, but more pronounced at that point.

12 Q. Okay. In describing that in your report, you
13 say, on page 6 of your report, section F,
14 gastrointestinal system, do you see that one? I'm
15 sorry, I may be --

16 A. Yes.

17 Q. You've got it?

18 A. Yes.

19 Q. Is it says, "A section of anus reveals
20 submucosal hemorrhage."

21 A. Yes.

22 Q. Where did you explain submucosal hemorrhage?

23 A. That is in the microscopic, "A section of
24 anus reveals submucosal hemorrhage," yes, Counselor.
25 That would be the contusion.

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Deposition of Dr. Steven Hayne

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1 Q. And a contusion is?

2 A. Located at the point that I indicated to you.

3 Q. Okay. The definition of a contusion, what
4 would that be?

5 A. Contusion is a tearing of blood vessels
6 underneath the skin or mucosa with collection of blood
7 at that site manifested by an area of discoloration,
8 when one's looking at the injury, external to the
9 injury itself. The lining, either the skin or mucosa,
10 remains intact, and usually there's no bleeding on the
11 skin or mucosal surface.

12 Q. Okay.

13 A. If one takes a microscopic section, you can
14 see bleeding outside the vessels into the soft tissue,
15 which would separate congestion from a traumatic
16 injury, is a contusion.

17 Q. Okay. Final question, so -- being redundant,
18 but you're saying, your testimony today is it's still
19 consistent with what you testified to at trial, and
20 you wouldn't change it?

21 A. No, sir. I would only change it if I saw
22 additional information. And I'd like to point out, I
23 did not come to a final conclusion.

24 Q. Okay. But you would agree with your
25 testimony then that the injuries were consistent with

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Deposition of Dr. Steven Hayne

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1 an object being inserted or penetration?

2 MR. JICKA: Object to the form.

3 A. Yes, they were consistent with that.

4 MR. McNAMARA: That's all I have.

5 MR. JICKA: Just one second. Let's go off
6 the record.

7 MR. MAGEE: Off the record. The time is
8 9:53.

9 (Recess.)

10 MR. MAGEE: This concludes the deposition.

11 The time is 9:56.

12 (Whereupon the deposition was concluded at
13 9:56 a.m., the same day.)

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1 CERTIFICATE OF COURT REPORTER

2 I, Catherine M. White, C.S.R. and Notary
3 Public, Hinds County, Mississippi, do hereby certify:

4 That on the 23rd day of November, 2010, there
5 appeared before me, pursuant to notice and the Federal
6 Rules of Civil Procedure, Dr. Steven Hayne as a witness
7 in the above-mentioned cause;

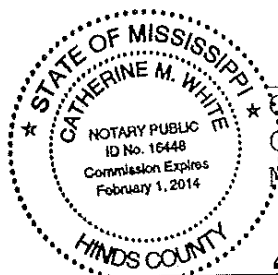
8 That said witness was duly sworn by me to tell
9 the whole truth, and nothing but the truth in said
10 cause;

11 That counsel appeared on behalf of the
12 respective parties as hereinbefore set forth;

13 That the foregoing deposition was taken by me
14 by means of Stenograph machine and translated into
15 transcript form by me, and that the foregoing 38 pages
16 contain a full, true and correct transcription of the
17 testimony of said witness;

18 That I am not in any way associated with any of
19 the parties to said cause of action, or their counsel,
20 and that I am not interested in the event hereof.

21 IN WITNESS WHEREOF, I have hereunto set my hand
22 this the 29th day of November, 2010.



Catherine M. White

24 Catherine M. White

25 CSR No. 1309

My Commission expires: 2/1/2014

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1 (Pages 1 to 4)

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<p>IN THE UNITED STATES DISTRICT COURT FOR THE SOUTHERN DISTRICT OF MISSISSIPPI WESTERN DIVISION</p> <p>JEFFREY HAVARD PETITIONER VS. CIVIL ACTION NO. 5:08-CV-275-KS CHRISTOPHER EPPS, et al. RESPONDENTS</p> <p>*****</p> <p>DEPOSITION OF DR. STEVEN HAYNE</p> <p>Taken at the offices of Watkins & Eager, 400 East Capitol Street, Jackson, Mississippi, on Tuesday, November 23, 2010, beginning at approximately 8:57 a.m. *****</p> <p>APPEARANCES NOTED HEREIN</p> <p>CATHY M. WHITE, CSR NO. 1309 PROFESSIONAL COURT REPORTING, LLC Post Office Box 320928 Jackson, Mississippi 39232-0928 (601) 919-8662</p>	<p>TABLE OF CONTENTS</p> <p>PAGE</p> <p>1 Title Page 1</p> <p>2 Appearance Page 2</p> <p>3 Table of Contents 3</p> <p>4 Index of Exhibits 3</p> <p>5 EXAMINATION INDEX</p> <p>6 Dr. Steven Hayne</p> <p>7 BY MR. JICKA 4</p> <p>8 BY MR. McNAMARA 33</p> <p>9 Certificate Page 39</p> <p>10 EXHIBIT INDEX</p> <p>11 MAR</p> <p>12 Exhibit</p> <p>13 1 Final Report of Autopsy 9</p> <p>14 2 Permit 10</p> <p>15 3 Declaration 14</p> <p>16 4 Medical records 19</p> <p>17 5 Crime lab report 30</p> <p>18 6 Notice 33</p> <p>19 7 Photocopy of 3 photographs 34</p> <p>20</p> <p>21</p> <p>22</p> <p>23</p> <p>24</p> <p>25</p>
<p>Page 2</p> <p>1 APPEARANCES</p> <p>2</p> <p>3 MARK JICKA, ESQUIRE</p> <p>4 mjicka@watkinseager.com</p> <p>5 Watkins & Eager</p> <p>6 400 East Capitol Street, Suite 300</p> <p>7 Jackson, Mississippi 39201</p> <p>8 GRAHAM P. CARNER, ESQUIRE</p> <p>9 gcarner@gilliamfirm.com</p> <p>10 The Gilliam Firm</p> <p>11 606 Highway 80 West, Suite D</p> <p>12 Clinton, Mississippi 39056</p> <p>13 COUNSEL FOR PETITIONER</p> <p>14 PATRICK J. McNAMARA, JR., ESQUIRE</p> <p>15 pmcna@ago.state.ms.us</p> <p>16 Office of the Attorney General</p> <p>17 450 High Street</p> <p>18 Jackson, Mississippi 39201</p> <p>19 COUNSEL FOR RESPONDENTS</p> <p>20 VIDEO SPECIALIST: Mr. Matthew Magee</p> <p>21</p> <p>22</p> <p>23</p> <p>24</p> <p>25</p>	<p>Page 4</p> <p>1 MR. MAGEE: Good morning. This is the</p> <p>2 videotaped deposition of Dr. Steven Hayne taken by</p> <p>3 counsel in the matter of Jeffrey Havard versus</p> <p>4 Christopher Epps, et al., in the District Court of the</p> <p>5 Southern District of Mississippi, Western Division.</p> <p>6 Today's date is November 23rd, 2010. The time is</p> <p>7 approximately 8:57 a.m. Counsel may now introduce</p> <p>8 themselves on record.</p> <p>9 MR. JICKA: I am Mark Jicka, and I represent</p> <p>10 Jeffrey Havard.</p> <p>11 MR. CARNER: Graham Carner, also for</p> <p>12 Mr. Havard.</p> <p>13 MR. McNAMARA: Pat McNamara representing the</p> <p>14 Attorney General and Christopher Epps.</p> <p>15 MR. MAGEE: The court reporter may now swear</p> <p>16 in the witness.</p> <p>17 (Witness sworn.)</p> <p>18 THE WITNESS: I'll waive and may I have a</p> <p>19 copy?</p> <p>20 DR. STEVEN HAYNE,</p> <p>21 having been duly sworn, was examined and testified as</p> <p>22 follows:</p> <p>23 EXAMINATION</p> <p>24 BY MR. JICKA:</p> <p>25 Q. Good morning, Dr. Hayne.</p>

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<p>1 A. Good morning, Counselor.</p> <p>2 Q. I'm going to ask you some questions today,</p> <p>3 and if you don't understand my questions, will you</p> <p>4 please let me know that?</p> <p>5 A. I will do that, sir.</p> <p>6 Q. And I will probably butcher some of these</p> <p>7 terminologies and pronunciations. So if you'll help</p> <p>8 me, if I say it in the wrong way, you're certainly</p> <p>9 welcome to correct my pronunciations.</p> <p>10 A. Thank you, Counselor.</p> <p>11 Q. Will you please provide the Court with your</p> <p>12 professional qualifications, sir?</p> <p>13 A. I'm a pathologist. I work in the fields of</p> <p>14 anatomic, clinical, and forensic pathology. I've</p> <p>15 worked in the field for some 35 years. I'm certified</p> <p>16 in anatomic pathology, clinical pathology, forensic</p> <p>17 pathology, forensic medicine, forensic physician.</p> <p>18 I've worked in the state of Mississippi for some 20</p> <p>19 years in different capacities in relationship to</p> <p>20 medical-legal investigation of death, including acting</p> <p>21 State Medical Examiner, designated State Pathologist,</p> <p>22 and Chief State Pathologist.</p> <p>23 Q. And tell me a little bit about your</p> <p>24 education, sir.</p> <p>25 A. I did the predominant of my undergraduate</p>	<p>1 paper, and published it. And it was basically</p> <p>2 identification, collection of evidence, treatment, and</p> <p>3 the like. It was a comprehensive paper, and it had a</p> <p>4 long checklist, so it could be posted in an emergency</p> <p>5 room somewhere, you can go right down the list. And</p> <p>6 also, when I was in the military, not by choice, but I</p> <p>7 had to do a lot of sexual assault work-ups in the</p> <p>8 United States Disciplinary Barracks at Fort</p> <p>9 Leavenworth, which, as you know, homosexuality in a</p> <p>10 military institution like that is a major offense</p> <p>11 under the Uniform Code of Military Justice. So I had</p> <p>12 to go in night after night and do that work. And many</p> <p>13 times we have had cases of sexual assault involving</p> <p>14 death of a human being that we've done medical-legal</p> <p>15 postmortem examinations on.</p> <p>16 Q. Have you been accepted as an expert in this</p> <p>17 field in courts?</p> <p>18 A. Yes, sir.</p> <p>19 MR. JICKA: Pat, I know the procedure here is</p> <p>20 a little different than a typical case, and I don't</p> <p>21 know if you would have any objection, but -- and I</p> <p>22 don't know if you have any questions, but we would</p> <p>23 tender him as an expert witness.</p> <p>24 MR. McNAMARA: He's already been accepted as</p> <p>25 an expert in this case.</p>
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<p>1 work at North Dakota State, spent two years at the</p> <p>2 University of North Dakota School of Medicine, and</p> <p>3 transferred to Brown University in Providence, Rhode</p> <p>4 Island, where I completed my medical degree, and then</p> <p>5 I went to San Francisco at Letterman Army Medical</p> <p>6 Center, where I trained in pathology. I rotated at</p> <p>7 numerous institutions in the San Francisco Bay area,</p> <p>8 including Children's Hospital, University of</p> <p>9 California Moffitt Hospital, Union Memorial Blood</p> <p>10 Bank, the Medical Examiner's Office for the City and</p> <p>11 County of San Francisco, as well as others, and then</p> <p>12 the last six months, I spent in nuclear medicine.</p> <p>13 Q. Can you list for the Court your</p> <p>14 qualifications in the area of child sexual abuse</p> <p>15 investigation and diagnosis?</p> <p>16 A. It's part of the field of forensic</p> <p>17 pathology. I've also authored in the field. I wrote</p> <p>18 a paper with Dr. Hammer, also a resident at the time,</p> <p>19 at -- stationed at the Presidio with Letterman Army</p> <p>20 Medical Center, in conjunction with my chief, Colonel</p> <p>21 Starkey, and the Chief of OBGYN, Colonel Ansbacher.</p> <p>22 We published that. It was a requirement for</p> <p>23 graduation of a residency program that you submit and</p> <p>24 have accepted a paper for publication. So Dr. Hammer</p> <p>25 and I were pretty good friends, so we co-authored the</p>	<p>1 MR. JICKA: Okay. And I would agree with you</p> <p>2 on that.</p> <p>3 BY MR. JICKA:</p> <p>4 Q. Dr. Hayne, you performed an autopsy on Chloe</p> <p>5 Britt; is that correct?</p> <p>6 A. Yes, Counselor. You pronounce it Chole</p> <p>7 Britt.</p> <p>8 Q. I think it's Chloe.</p> <p>9 A. Chloe?</p> <p>10 Q. But I'm not sure.</p> <p>11 A. Because it is an Hispanic name. It would be</p> <p>12 Chole (sic) if it was in Spanish. Maybe it would be</p> <p>13 Chole.</p> <p>14 Q. Why don't we call her Miss Britt? And that</p> <p>15 was part of your duties in your profession; is that</p> <p>16 correct?</p> <p>17 A. That's correct. Now, on that date of 2002,</p> <p>18 actually, it was the 22nd of February when the</p> <p>19 postmortem examination was conducted.</p> <p>20 Q. And do you have a copy, Dr. Hayne, of your</p> <p>21 final report of autopsy with you today, sir?</p> <p>22 A. I do, Counselor.</p> <p>23 MR. JICKA: Okay. And, Pat, I'm going to</p> <p>24 mark that final report of autopsy as an exhibit to his</p> <p>25 deposition.</p>

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<p>1 (Exhibit 1 marked.)</p> <p>2 BY MR. JICKA:</p> <p>3 Q. Dr. Hayne, what was the purpose for you doing</p> <p>4 an autopsy on Miss Britt?</p> <p>5 A. It was to come to conclusions as to cause and</p> <p>6 manner of death, cause of death being the medical</p> <p>7 reason Miss Britt died, and the manner of death is the</p> <p>8 classification of the death. And one has to come to a</p> <p>9 conclusion, if it's suicide, accident, homicide,</p> <p>10 natural, pending, or undetermined. Of course,</p> <p>11 sometimes, cause of death, one cannot come to a</p> <p>12 conclusion.</p> <p>13 Q. Okay. And were you asked to do that by the</p> <p>14 coroner of Adams County, sir?</p> <p>15 A. The county coroner, medical examiner,</p> <p>16 investigator is his official title, and it was James</p> <p>17 Lee.</p> <p>18 Q. And as part of his request for you to do an</p> <p>19 autopsy on Miss Britt, was there documentation or a</p> <p>20 permit that was issued to you by the Adams County</p> <p>21 Coroner?</p> <p>22 A. Yes, Counselor, there's a State form called a</p> <p>23 ME-1, Medical Examiner 1 form, and that I made part of</p> <p>24 the postmortem examination as a routine practice of</p> <p>25 business.</p>	<p>1 Q. All right. But even from the beginning of</p> <p>2 your work in this case, you knew that sexual assault</p> <p>3 was at least an issue, at least in the minds of the</p> <p>4 coroner and the district attorney, as presented to</p> <p>5 you?</p> <p>6 A. Not only from the paperwork, Counselor, but</p> <p>7 also from telephonic communication from the County</p> <p>8 Coroner, Medical Examiner, Investigator.</p> <p>9 Q. You did conduct an autopsy on Miss Britt; is</p> <p>10 that correct?</p> <p>11 A. I did, Counselor.</p> <p>12 Q. And in the report, there's no mention of a</p> <p>13 sexual battery on this child; is that correct?</p> <p>14 A. That is correct.</p> <p>15 Q. And why is that not listed as something in</p> <p>16 your final report of autopsy?</p> <p>17 A. I could not come to a final conclusion as to</p> <p>18 that, Counselor.</p> <p>19 Q. Okay.</p> <p>20 A. There was one injury that I indicated would</p> <p>21 be consistent with the penetration of the anal area,</p> <p>22 but that, in and of itself, I didn't feel was enough</p> <p>23 to come to a conclusion that there was a sexual</p> <p>24 assault in this particular death.</p> <p>25 Q. Okay. When you did your autopsy, you were</p>
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<p>1 MR. JICKA: And I'm going to mark that, Pat,</p> <p>2 as Exhibit 2, the permit from the Coroner of Adams</p> <p>3 County.</p> <p>4 (Exhibit 2 marked.)</p> <p>5 BY MR. JICKA:</p> <p>6 Q. What is the purpose when you receive this</p> <p>7 permit, as you use it in your work?</p> <p>8 A. Well, it's the request from the County in</p> <p>9 writing to perform a medical-legal or forensic autopsy</p> <p>10 the remains so identified on the paperwork, the ME-1</p> <p>11 -- or ME-17 form.</p> <p>12 Q. And on the permit that involves Miss Britt,</p> <p>13 it lists different circumstances, I believe, for you</p> <p>14 to, I guess, determine or to look at as you're</p> <p>15 conducting your autopsy; is that correct?</p> <p>16 A. That's correct.</p> <p>17 Q. And one of those I see there is a note about</p> <p>18 sexual assault. Do you see that located?</p> <p>19 A. I do.</p> <p>20 Q. And as part of your autopsy, even from the</p> <p>21 beginning of the autopsy, was it part of your work to</p> <p>22 determine whether there could be shown that there was</p> <p>23 a sexual assault in this case?</p> <p>24 A. In fact, to come to a conclusion, that -- or</p> <p>25 not come to a conclusion, final conclusion. 486</p>	<p>1 not able to find any tearing of the anal area on this</p> <p>2 child; is that right?</p> <p>3 A. No, there was not.</p> <p>4 Q. If that is something that you had noted or</p> <p>5 found, then would you have noted it in your report,</p> <p>6 correct?</p> <p>7 A. I would have.</p> <p>8 Q. And you also would have had photographs that</p> <p>9 would have shown that on this child, correct?</p> <p>10 A. I would have.</p> <p>11 Q. All right. And it's mentioned -- sexual</p> <p>12 assault or battery is not mentioned anywhere in this</p> <p>13 report; is that correct?</p> <p>14 A. No, I did not see evidence of that,</p> <p>15 Counselor. I was asked in court, but I did not see</p> <p>16 evidence in the autopsy, and, therefore, did not</p> <p>17 reflect it in the report.</p> <p>18 Q. You did find a one-centimeter contusion; is</p> <p>19 that correct?</p> <p>20 A. That's correct.</p> <p>21 Q. Just for the record, how big is a</p> <p>22 one-centimeter contusion?</p> <p>23 A. Approximately like that, Counselor.</p> <p>24 Q. Okay. Now, but that was not listed in the</p> <p>25 list on the autopsy report as a traumatic injury; is</p>

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<p>1 that correct?</p> <p>2 A. It wasn't, but it was listed in the body of</p> <p>3 the report, and also in the illustration body diagram.</p> <p>4 Q. In other words, you noted it in your report,</p> <p>5 but did not list it as a traumatic injury to this</p> <p>6 child?</p> <p>7 A. That's correct.</p> <p>8 Q. And is that because there could be many</p> <p>9 possible alternative causes for a contusion such as</p> <p>10 this found on this child?</p> <p>11 A. It's probably a typo error, Counselor,</p> <p>12 because I'm sure I dictated it, but the typist skipped</p> <p>13 it.</p> <p>14 Q. All right. The photographs we mentioned</p> <p>15 didn't show any tearing; is that correct?</p> <p>16 A. That is correct.</p> <p>17 Q. All right. And, further, no tearing was</p> <p>18 listed or noted in the autopsy report?</p> <p>19 A. No lacerations or abrasions were identified,</p> <p>20 only a single contusion.</p> <p>21 Q. In this case, Dr. Hayne, you had prepared</p> <p>22 earlier a declaration. Have you had an opportunity to</p> <p>23 look at that?</p> <p>24 A. I have.</p> <p>25 MR. JICKA: I'm going to mark this, Pat, as</p>	<p>1 healed between the time that Miss Britt was seen in</p> <p>2 the emergency room and that you performed the autopsy?</p> <p>3 A. They would not.</p> <p>4 Q. I want to ask a little bit about this area of</p> <p>5 the human body. Do you agree that there's a delicate</p> <p>6 tissue lining of the anus rectum that can be damaged</p> <p>7 easily in a child of this age?</p> <p>8 A. It can. It is a squamous mucosa lining, not</p> <p>9 skin.</p> <p>10 Q. Okay.</p> <p>11 A. And that is more easily injured, traumatized,</p> <p>12 than skin surface.</p> <p>13 Q. And an injury can occur in a child like this,</p> <p>14 even by the application of a rectal thermometer; is</p> <p>15 that correct?</p> <p>16 A. That could happen, but, Counselor, I think</p> <p>17 that would be highly unlikely to see an injury of such</p> <p>18 size as secondary to the placement of a thermometer by</p> <p>19 medical personnel.</p> <p>20 Q. Okay. All right. And in reviewing the</p> <p>21 medical records, did you see where her temperature was</p> <p>22 taken by rectal thermometer on multiple occasions</p> <p>23 while she was in the emergency room?</p> <p>24 A. I did see that, sir.</p> <p>25 Q. As part of the final autopsy report, there's</p>
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<p>1 the next numbered exhibit to Dr. Hayne's deposition,</p> <p>2 which will be Exhibit 3.</p> <p>3 (Exhibit 3 marked.)</p> <p>4 BY MR. JICKA:</p> <p>5 Q. Dr. Hayne, were you able to review this</p> <p>6 declaration and correct it for any errors prior to</p> <p>7 executing it on March 5th, 2009?</p> <p>8 A. Well, sir, I'm looking to see if I can find</p> <p>9 in my file here what you're addressing.</p> <p>10 Q. I've got an extra copy.</p> <p>11 A. Thank you.</p> <p>12 Q. In this declaration, Dr. Hayne, it, first of</p> <p>13 all, involves your work and your opinions in the</p> <p>14 Jeffrey Havard matter, correct?</p> <p>15 A. That's true.</p> <p>16 Q. And you state, again, and forgive me, Pat,</p> <p>17 I'm going to try not to be too redundant on this in</p> <p>18 this deposition today, but, in there, you state that</p> <p>19 you found no tears -- this is in paragraph seven,</p> <p>20 Dr. Hayne.</p> <p>21 A. Yes, sir.</p> <p>22 Q. No tears to the rectum, anus, anal sphincter</p> <p>23 or perineum; is that correct?</p> <p>24 A. That's correct.</p> <p>25 Q. And it's not possible that tears would not</p>	<p>1 also a mention of a sexual assault kit.</p> <p>2 A. An RSVK 1111 kit was employed to collect</p> <p>3 evidence that was subsequently submitted to the</p> <p>4 Mississippi Crime Lab under chain of custody.</p> <p>5 Q. And as part of your work here, and as a</p> <p>6 result of the sexual assault kit, isn't it true that</p> <p>7 there was no semen found after a serological</p> <p>8 evaluation conducted on this child?</p> <p>9 A. Actually, by microscopic examination, but no</p> <p>10 spermatozoa were identified.</p> <p>11 Q. Okay. And swabs -- I guess what happens is</p> <p>12 that you will take swabs from different areas of the</p> <p>13 child's anatomy; is that correct?</p> <p>14 A. That's correct.</p> <p>15 Q. And then you will look under a microscope for</p> <p>16 any evidence that there might be sperm; is that</p> <p>17 correct?</p> <p>18 A. That's correct. We look both oral, anal, and</p> <p>19 vaginal.</p> <p>20 Q. And on this, it looks like, from the oral</p> <p>21 swab, the vaginal, and the rectal swab, that there was</p> <p>22 no evidence found of spermatozoa; is that correct?</p> <p>23 A. That's correct. There are additional tests</p> <p>24 that can be performed, serological tests, and I</p> <p>25 believe those were performed, too, and they were also</p>

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<p>1 negative.</p> <p>2 Q. Okay. And the serological evaluation was</p> <p>3 done with -- from an oral standpoint, a vulvar</p> <p>4 standpoint, a vaginal standpoint, and a rectal</p> <p>5 standpoint; is that --</p> <p>6 A. I believe that is correct, sir.</p> <p>7 Q. Dr. Hayne, what are the signs of brain death</p> <p>8 or lack of brain function in a child like this?</p> <p>9 A. If you have brain death, first, there would</p> <p>10 be flaccidness. There would be unconsciousness.</p> <p>11 There would be muscle relaxation. There would be lack</p> <p>12 of breathing, unless there was artificial respiration</p> <p>13 being delivered. Body functions would essentially</p> <p>14 cease, either at that time or shortly thereafter.</p> <p>15 Eventually, there would be breakdown in tissue,</p> <p>16 lytolysis, purification, and the like.</p> <p>17 Q. Okay. Reviewing the medical records for</p> <p>18 Miss Britt, I noted certain things, and I want to just</p> <p>19 mention and ask if these are signs or could be signs</p> <p>20 of lack of brain function, some of which you've</p> <p>21 already mentioned. Dilated pupils, sir?</p> <p>22 A. That would be.</p> <p>23 Q. Fixed pupils?</p> <p>24 A. That would be.</p> <p>25 Q. Lack of muscle tone?</p>	<p>1 system, somatic, cellular, and they all vary, you</p> <p>2 know, as to response of an individual.</p> <p>3 Q. Based upon -- you've reviewed the medical</p> <p>4 records for Miss Britt in this case; is that correct?</p> <p>5 A. I have, Counselor.</p> <p>6 MR. JICKA: I'm going to mark those as</p> <p>7 Exhibit 4 to your deposition.</p> <p>8 (Exhibit 4 marked.)</p> <p>9 BY MR. JICKA:</p> <p>10 Q. Based upon the information available to you,</p> <p>11 Dr. Hayne, was Chloe Britt brain dead or lacked brain</p> <p>12 function at the time that her anal dilation was first</p> <p>13 noted?</p> <p>14 A. It was.</p> <p>15 Q. And this was after she was successfully</p> <p>16 intubated; is that correct?</p> <p>17 A. That's correct.</p> <p>18 Q. And is this an opinion within a reasonable</p> <p>19 degree of medical certainty, sir?</p> <p>20 A. As reflected in the medical record, yes.</p> <p>21 Q. Okay. Do you commonly encounter dilated anal</p> <p>22 sphincters during a postmortem examination?</p> <p>23 A. It can occur, but it's not as common as I</p> <p>24 think people think.</p> <p>25 Q. Is that a recognized finding in the</p>
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<p>1 A. That would be, also.</p> <p>2 Q. Asystole?</p> <p>3 A. Asystole?</p> <p>4 Q. Asystole, thank you.</p> <p>5 A. Yes. That would be if the heart is no longer</p> <p>6 functioning. You can have brain death and still have</p> <p>7 functioning of the heart. Cardiovascular</p> <p>8 functionality could remain for a period of time, and</p> <p>9 respiratory could for a period of time, too.</p> <p>10 MR. McNAMARA: I would have to interject and</p> <p>11 object at this time based on this is outside the scope</p> <p>12 of what we're here for as far as the sexual assault</p> <p>13 goes, without it being tied together as it is, and I</p> <p>14 would object to the continuing leading of the witness.</p> <p>15 MR. JICKA: Okay. And I'll -- I will try not</p> <p>16 to lead. Dr. Hayne has a kind of interesting position</p> <p>17 in this case, so I'm not sure exactly what witness he</p> <p>18 would be considered by the Court, but I'll -- I don't</p> <p>19 mind asking nonleading questions.</p> <p>20 A. May I interject one part to my -- one last</p> <p>21 part to my answer?</p> <p>22 BY MR. JICKA:</p> <p>23 Q. Sure.</p> <p>24 A. There are many definitions of death. It</p> <p>25 could be cardiovascular, respiratory, central ne</p>	<p>1 postmortem period?</p> <p>2 A. It can be, yes.</p> <p>3 Q. And do children who have died of brain</p> <p>4 injuries have an increased likelihood of having a</p> <p>5 dilated anus postmortem?</p> <p>6 A. It's possible. I think you supplied me with</p> <p>7 one article from the Orange Journal, '97, "American</p> <p>8 Journal of Forensic Medicine and Pathology." In that</p> <p>9 particular article, there were 65 cases of which only</p> <p>10 a handful were involving children of less than one</p> <p>11 year of age, and of those --</p> <p>12 MR. McNAMARA: I object again. This is not</p> <p>13 relevant to what we're speaking about. This is a</p> <p>14 general study. This is not the case that we're</p> <p>15 talking about.</p> <p>16 BY MR. JICKA:</p> <p>17 Q. Go ahead, sir.</p> <p>18 A. And of all those, only one had suffered a</p> <p>19 traumatic death. In that particular case, the anus</p> <p>20 was described as slit-like. So in that case, there</p> <p>21 was no dilatation in a violent death that</p> <p>22 Dr. Lauridson is referring to in his opinion of 65</p> <p>23 cases published in the Orange Journal.</p> <p>24 MR. JICKA: And, Pat, I don't -- certainly</p> <p>25 I'm not dismissing your objection, but this goes</p>

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<p>1 directly to what we believe to be an issue in this</p> <p>2 case and allowed by Judge Starrett in his order.</p> <p>3 BY MR. JICKA:</p> <p>4 Q. Can resuscitation efforts result in a large</p> <p>5 amount of gas accumulating in the gastrointestinal</p> <p>6 tract?</p> <p>7 A. Ineffective resuscitation, cardiopulmonary</p> <p>8 resuscitation. I do not believe that was the case in</p> <p>9 this particular individual, in that there was stool in</p> <p>10 the large bowel, and that would have effectively</p> <p>11 blocked the passage of air going down the</p> <p>12 gastrointestinal tract and dilating the distal part of</p> <p>13 the GI tract.</p> <p>14 Q. So can this gas, the air and the amount of</p> <p>15 pressure on the bowel and colon, facilitate the</p> <p>16 passage of stool?</p> <p>17 A. It's possible, yes, ineffective</p> <p>18 cardiopulmonary resuscitation.</p> <p>19 Q. And isn't that what they had at the emergency</p> <p>20 room here, they had an ineffective CPR with this</p> <p>21 child?</p> <p>22 A. It would only be my impression. They are</p> <p>23 medically-trained personnel to deliver cardiopulmonary</p> <p>24 resuscitation in an adequate manner.</p> <p>25 Q. But this child was not revived at any point</p>	<p>1 A. That would be reasonable that she would have</p> <p>2 been dead.</p> <p>3 Q. Okay.</p> <p>4 A. You can survive for a few minutes with oxygen</p> <p>5 deprivation, if it's total oxygen deprivation. The</p> <p>6 brain has a store of glucose and oxygen for</p> <p>7 approximately 15 to 30 seconds, then unconsciousness</p> <p>8 will commence, and shortly after that, within two to</p> <p>9 three minutes, death will intervene.</p> <p>10 Q. In your autopsy report, Dr. Hayne, you note,</p> <p>11 several times, congestion. If you'll look -- you see</p> <p>12 on your finding, sir?</p> <p>13 A. Yes, sir.</p> <p>14 Q. Can congestion cause contusions?</p> <p>15 A. No.</p> <p>16 Q. Okay. The congestion that you found with</p> <p>17 Chloe Britt, where was it located?</p> <p>18 A. It was in the viscera, the major organs.</p> <p>19 That's not to be unexpected. I don't think this death</p> <p>20 was an immediate death, and there would be a period of</p> <p>21 time, an agonal phase of death where the</p> <p>22 cardiovascular activity would be diminishing, pumping</p> <p>23 efficiency would also diminish, and blood would have a</p> <p>24 tendency to pool in the different organs, the lungs,</p> <p>25 spleen, kidneys, and the like, the liver.</p>
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<p>1 in time that you reviewed in the medical records?</p> <p>2 A. No, sir, was not.</p> <p>3 Q. Okay. If the gas enters into the colon,</p> <p>4 could that cause distention of the colon, and the</p> <p>5 rectum, and promote further dilation of the anus?</p> <p>6 A. If that had occurred, yes sir. I saw no</p> <p>7 evidence of that occurring, but if -- in a general</p> <p>8 sense, if gas is pushing stool, it can dilate, pack</p> <p>9 the stool, enlarging the distal bowel, yes, it could</p> <p>10 do that.</p> <p>11 Q. Okay. And could a spontaneous bowel movement</p> <p>12 also contribute to anal dilation?</p> <p>13 A. Only if they're very hard stool would I</p> <p>14 expect to see that, if there's enough pressure with</p> <p>15 force with the chest or enema, you can -- even in</p> <p>16 cases of acute appendicitis, in patients that have</p> <p>17 survived. So that can occur, but that's pushing stool</p> <p>18 down into the space of the vermiform appendix, but I</p> <p>19 didn't see evidence of that in this particular case.</p> <p>20 Q. If Chloe Britt was oxygen deprived for 45</p> <p>21 minutes to an hour before the anal dilation, is it</p> <p>22 possible that she was -- was located, is it probable</p> <p>23 that she lacked brain function?</p> <p>24 A. Forty-five minutes?</p> <p>25 Q. Forty-five minutes to an hour?</p>	<p>1 Q. The inner mucosa of rectum, is it sometimes</p> <p>2 visible after death in an autopsy?</p> <p>3 A. It could be. It's unusual. You would have</p> <p>4 to spread the buttocks to look and see that.</p> <p>5 Q. And what would it look like? Would it have a</p> <p>6 pink or red coloring to it?</p> <p>7 A. Usually be a pinkish color, where there would</p> <p>8 be congestion, usually dependent from the geographic</p> <p>9 or the gravitational pull of blood downward.</p> <p>10 Q. And if that inner mucosal lining was observed</p> <p>11 even by physicians, could it be confused as an anal</p> <p>12 injury?</p> <p>13 A. I would think not, Counselor. I can't speak</p> <p>14 for them, but a contusion is usually fairly-well</p> <p>15 circumscribed and outlined, while congestion would not</p> <p>16 be, but I would hate to speak for them.</p> <p>17 Q. Okay. Flaccid, that's the same as limp; is</p> <p>18 that correct?</p> <p>19 A. That's correct.</p> <p>20 Q. Could a flaccid or limp muscle condition</p> <p>21 contribute to anal dilation?</p> <p>22 A. That could, yes.</p> <p>23 Q. Okay. And a dilated anal sphincter is not,</p> <p>24 on its own, evidence of anal sexual abuse; is that</p> <p>25 correct?</p>

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<p>1 A. It is not by itself, no.</p> <p>2 Q. Okay. To determine that sexual abuse is a</p> <p>3 probability, you would need additional evidence than</p> <p>4 just the dilated anus; is this correct?</p> <p>5 A. I would like to see more evidence as to</p> <p>6 traumatic injuries, also clinical history, and,</p> <p>7 hopefully, by laboratory testing.</p> <p>8 Q. Okay. And we don't have here in your</p> <p>9 analysis, and your autopsy of Miss Britt, that</p> <p>10 additional type of evidence; is that correct?</p> <p>11 A. Do not. I only have a contusion, which is a</p> <p>12 traumatic injury. We do not have abrasions,</p> <p>13 lacerations, presence of seminal fluid, spermatozoa,</p> <p>14 and the like.</p> <p>15 Q. And, Dr. Hayne, can you say from your autopsy</p> <p>16 evidence, and from the coroner's inquest, the medical</p> <p>17 records that you reviewed, the photographs, and the</p> <p>18 laboratory findings, that this child, Miss Britt, was</p> <p>19 sexually assaulted?</p> <p>20 A. I could not come to that final conclusion,</p> <p>21 Counselor. As I remember in trial testimony, I said</p> <p>22 that the contusion would be consistent with a sexual</p> <p>23 abuse, but I couldn't say that there was sexual abuse,</p> <p>24 and, basically, I deferred to the clinical examination</p> <p>25 conducted at the hospital.</p>	<p>1 MR. McNAMARA: Object to anything along this</p> <p>2 line. The doctor has stated he is not familiar with</p> <p>3 their qualifications. He'd be completely incompetent</p> <p>4 to answer any questions regarding that.</p> <p>5 BY MR. JICKA:</p> <p>6 Q. Do you know what, if any, experience they had</p> <p>7 ever treating children that had had sexual abuse?</p> <p>8 A. I don't know that, Counselor.</p> <p>9 Q. Would you agree that it takes a certain</p> <p>10 medical expertise to determine whether a child has</p> <p>11 ever been sexually abused?</p> <p>12 A. I would agree with that, yes.</p> <p>13 Q. And in this case, from your work, hired by</p> <p>14 the State, you could not make a determination that</p> <p>15 sexual abuse was a probability in this case, correct?</p> <p>16 A. I could not come to a final conclusion,</p> <p>17 Counselor. I could only come to the conclusion I so</p> <p>18 testified in court, that the contusion was consistent</p> <p>19 with what I've seen in a sexual abuse case. And also,</p> <p>20 just technically, I was contracted not with the State,</p> <p>21 but by the County.</p> <p>22 Q. Thank you.</p> <p>23 A. Adams County.</p> <p>24 Q. And I appreciate it. Thank you for</p> <p>25 correcting that. Dr. Hayne, you testified at Jeffrey</p>
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<p>1 Q. And so from your standpoint and from your</p> <p>2 expertise, you cannot say that this child was sexually</p> <p>3 abused, to a reasonable degree of medical certainty;</p> <p>4 is that correct?</p> <p>5 A. I could not now and I could not then, either;</p> <p>6 at the trial, or when I wrote the report, or discussed</p> <p>7 the case with the coroner.</p> <p>8 Q. Okay. Is physical sexual abuse of a child a</p> <p>9 medical diagnosis?</p> <p>10 A. Well, there's a component of a medical</p> <p>11 diagnosis. You're describing also a legal issue, too.</p> <p>12 Q. Right.</p> <p>13 A. The diagnosis could come from laboratory</p> <p>14 testing. It could come from physical exam by a</p> <p>15 treating physician. It could also come from a</p> <p>16 pathologist in a case where there's death, also from</p> <p>17 scene investigation. So it's a combination of things,</p> <p>18 but it's also a legal, and as you notice, I never used</p> <p>19 the term, "rape." That is a legal term, not a medical</p> <p>20 term.</p> <p>21 Q. Yes, sir. Are you familiar with the</p> <p>22 expertise of the doctors and nurses that treated this</p> <p>23 child at the emergency room?</p> <p>24 A. I'm not.</p> <p>25 Q. Do you know --</p>	<p>1 Havard's trial, correct?</p> <p>2 A. I did, sir.</p> <p>3 Q. And you were not asked, actually, about</p> <p>4 sexual battery during that trial, were you, sir?</p> <p>5 A. Not specifically, no.</p> <p>6 Q. But you were aware, from even from the</p> <p>7 coroner's permit, that that was an issue in the case,</p> <p>8 correct?</p> <p>9 A. Oh, yes, and I knew before I even stepped on</p> <p>10 the witness stand that was going to be an issue.</p> <p>11 Q. Okay. And prior to the trial, you discussed</p> <p>12 this with the district attorney whether you could say</p> <p>13 to a reasonable degree of medical certainty or even to</p> <p>14 a probability that sexual abuse occurred, correct?</p> <p>15 A. That's correct. But all I could tell the</p> <p>16 district attorney, prior to trial, was that there was</p> <p>17 a contusion, and that would be consistent with sexual</p> <p>18 abuse, but I'd like to see more evidence before I made</p> <p>19 that next and more significant evaluation and</p> <p>20 conclusion.</p> <p>21 Q. Okay. You -- if you had been asked the same</p> <p>22 questions we -- that I've been asking you today in</p> <p>23 court about sexual abuse, would you have answered them</p> <p>24 in the same manner, sir?</p> <p>25 A. Exact way. I think I at least touched on</p>

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<p>1 some of those, and I have not changed my opinion, and 2 it would make no difference whether defense or 3 prosecution was asking me, the answer would be the 4 same. 5 Q. That leads me to my next question. Did you 6 ever meet with Gus Sermos or Robert Clark, 7 Mr. Havard's attorneys about this case? 8 A. I don't remember that, Counselor, but I -- 9 MR. McNAMARA: And I object. This is off the 10 subject, not relevant. 11 BY MR. JICKA: 12 Q. If requested by them, would you have met with 13 the attorneys for Mr. Havard in this case? 14 A. I always honor those requests, either 15 prosecution or defense. 16 Q. And would you have answered their questions 17 in a meeting the same way you have today, if asked? 18 A. If they were asking the same questions, I 19 would respond the same way. 20 Q. Dr. Hayne, you can't say, or can you say, 21 that Chloe Britt was sexually penetrated to a 22 reasonable degree of medical certainty in this case? 23 A. I cannot. All I can say is the injury 24 sustained would be consistent with that, but that's 25 not a definitive diagnosis. And maybe I should</p>	<p>1 the studies that -- 2 MR. McNAMARA: I'll have to object. It 3 sounds like the doctor is not familiar with this 4 document. 5 MR. JICKA: All right. 6 BY MR. JICKA: 7 Q. Go ahead, sir. 8 A. And then remarks that some of the specimens 9 were retained for DNA testing, also on an Eddie 10 Walker. From an Eddie Walker, I should say. 11 Q. And, basically, in Exhibit 5, we have some 12 results from a sexual assault evidence collection kit 13 labeled Jeffrey Havard; is that correct? 14 A. Yes, sir. 15 Q. And in your work, are you familiar what makes 16 up these sexual assault evidence collection kits? 17 A. I am, sir. We use them routinely. 18 Q. And what is that, sir? 19 A. RSVK 1111 kit, that would be for collection 20 of saliva, collection of vaginal in fluid, rectal 21 swabs, vaginal swabs, vulvar swabs, oral swabs, any 22 clothing, hair samples, and the like, also, DNA tube 23 of blood. 24 Q. And in all of the evidence that you had 25 mentioned and that's shown here on Exhibit 5, was</p>
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<p>1 explain. 2 Q. Sure. 3 A. I use a series of qualifiers, with reasonable 4 medical certainty, I can say exclude, suggestive of, 5 may fit, consistent with, and diagnostic of. 6 Q. Okay. Let's go off the record for a second. 7 Let me review my notes and see what else I have. 8 A. Sure. 9 MR. MAGEE: Off the record. The time is 10 9:30. 11 (Recess.) 12 (Exhibit 5 marked.) 13 MR. MAGEE: Back on the record. The time is 14 9:40. 15 BY MR. JICKA: 16 Q. Dr. Hayne, thank you for helping me through 17 this information today. What I'd like to do is show 18 you what I've marked as Exhibit 5, and ask you if you 19 can identify what that document is, sir? 20 A. This is a report from the Mississippi Crime 21 Lab, their facility in Jackson, concerning samples 22 that were collected. This would be -- appears to be 23 from the hospital, including clothing, and then 24 there's also a pillow case, and there's a purple-top 25 tube of blood, and then it discusses the results of</p>	<p>1 there any evidence or DNA connecting Jeffrey Havard 2 with a sexual abuse of Miss -- of the child, Miss 3 Britt? 4 A. In this particular one, I do not see evidence 5 of that. This is basically clothing and other items 6 involving the defendant and the decedent. This is not 7 the material, that I can determine, that was submitted 8 from the autopsy itself. 9 Q. So this would be additional materials that 10 were tested with -- under the sexual assault evidence 11 kit, in addition to the swabs that you've already 12 testified about; is that correct? 13 A. That's correct. It indicates such items as 14 clothes removed at Natchez Community Hospital. 15 MR. McNAMARA: And for the record, I continue 16 to object. This is not a document that the doctor is 17 familiar with or was generated by the doctor. 18 A. And fitted sheet beside a stove, and a used 19 baby diaper, and items like that, Counselor. 20 BY MR. JICKA: 21 Q. Thank you, sir. All right. That's going to 22 be Exhibit 5. Dr. Hayne, I usually start with this, 23 but I guess I'll end at least your direct examination 24 with this. We had noticed your deposition and asked 25 you to bring anything that you had with you regarding</p>

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<p>1 this matter. What do you have in your possession 2 involving this Jeffrey Havard matter, sir? 3 A. This is the complete file, and I also brought 4 a tape. This the complete file that I have, 5 Counselor. 6 MR. JICKA: Okay. Thank you, sir. All 7 right. I'm going to make Exhibit 6 his notice of the 8 videotaped deposition. All right. We will tender the 9 witness, Pat. 10 (Exhibit 6 marked.) 11 EXAMINATION 12 BY MR. McNAMARA: 13 Q. Doctor, let's start off real quickly and just 14 ask you, is your -- in your opinion, the testimony 15 that you've given today, is it consistent with the 16 testimony that you gave at trial? 17 A. It is, sir. 18 Q. Have you had any change of heart? Would you 19 change your testimony? 20 A. I've seen no new facts to change my 21 testimony, Counselor. 22 Q. Okay. I'll ask -- I have here -- have you 23 seen the pictures you took at the autopsy -- 24 A. Not since the trial, sir. 25 Q. -- in review? Okay. I'll pass you these</p>	<p>1 It could be some other object. 2 Q. There are several references throughout the 3 trial, something about 12 o'clock, there was an injury 4 at 12 o'clock of the anal area? 5 A. Yes, Counselor. 6 Q. Where exactly is 12 o'clock on that? 7 A. May I point, Counselor? 8 Q. That would be at the top, where -- 9 A. Yes, Counselor. 10 Q. -- there's sort of a slender -- it's round in 11 one area, and then it goes up and it's sort of 12 slender? 13 A. That's correct, sir. 14 Q. Is that normal for a child to have that -- 15 that wouldn't be a tear, that would just be -- what 16 would that be? 17 A. For what? 18 Q. I'm sorry. The -- at 12 o'clock, it shows -- 19 the pictures you're holding, there is a picture of the 20 baby's anus? 21 A. That's correct. 22 Q. And it's rounded; is that correct? 23 A. It's elliptical. 24 Q. Well, toward the top of that 12 o'clock area, 25 does it -- it peaks, it goes up, and comes to a point;</p>
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<p>1 three -- what I have here is a copy of the three, and 2 we'll ask that that be substituted as an exhibit. And 3 can you identify those pictures or do you recall 4 those? They have your markings on there. 5 A. Yes, Counselor, I do recognize these. 6 (Exhibit 7 marked.) 7 BY MR. McNAMARA: 8 Q. Okay. One question I'd ask, as you see those 9 injuries to the child's anus there, do you find that 10 to be consistent with the insertion of a child's 11 rectal thermometer? 12 A. I did not think that was an insertion injury 13 from a rectal thermometer by medical personnel. I 14 could not exclude it, but I think it was unlikely, 15 Counselor. 16 Q. Okay. That is an abnormal anus, isn't it? 17 A. It is, Counselor. 18 Q. Did you -- to the question of the lack of 19 semen or DNA evidence, is there a requirement that 20 someone else's DNA or semen be present? 21 A. No, sir. 22 Q. They're just cause for penetration, is that 23 correct? 24 A. That's correct, sir. It does not necessarily 25 mean that a penis was the device used to penetrate</p>	<p>1 is that -- that's how I'm looking at it. 2 A. Yeah, it points towards the perineum, yes. 3 Q. Is that indicative of that's not a tear, that 4 would be just a stretch? 5 A. I did not see a tear, Counselor, no. 6 Q. What is that indicative of, that 12 o'clock 7 injury? 8 A. There was dilatation at that site, Counselor. 9 Q. Okay. But it was dilatation of the entire 10 anus, correct? 11 A. Yes, but more pronounced at that point. 12 Q. Okay. In describing that in your report, you 13 say, on page 6 of your report, section F, 14 gastrointestinal system, do you see that one? I'm 15 sorry, I may be -- 16 A. Yes. 17 Q. You've got it? 18 A. Yes. 19 Q. Is it says, "A section of anus reveals 20 submucosal hemorrhage." 21 A. Yes. 22 Q. Where did you explain submucosal hemorrhage? 23 A. That is in the microscopic, "A section of 24 anus reveals submucosal hemorrhage," yes, Counselor. 25 That would be the contusion.</p>

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<p>1 Q. And a contusion is?</p> <p>2 A. Located at the point that I indicated to you.</p> <p>3 Q. Okay. The definition of a contusion, what</p> <p>4 would that be?</p> <p>5 A. Contusion is a tearing of blood vessels</p> <p>6 underneath the skin or mucosa with collection of blood</p> <p>7 at that site manifested by an area of discoloration,</p> <p>8 when one's looking at the injury, external to the</p> <p>9 injury itself. The lining, either the skin or mucosa,</p> <p>10 remains intact, and usually there's no bleeding on the</p> <p>11 skin or mucosal surface.</p> <p>12 Q. Okay.</p> <p>13 A. If one takes a microscopic section, you can</p> <p>14 see bleeding outside the vessels into the soft tissue,</p> <p>15 which would separate congestion from a traumatic</p> <p>16 injury, is a contusion.</p> <p>17 Q. Okay. Final question, so -- being redundant,</p> <p>18 but you're saying, your testimony today is it's still</p> <p>19 consistent with what you testified to at trial, and</p> <p>20 you wouldn't change it?</p> <p>21 A. No, sir. I would only change it if I saw</p> <p>22 additional information. And I'd like to point out, I</p> <p>23 did not come to a final conclusion.</p> <p>24 Q. Okay. But you would agree with your</p> <p>25 testimony then that the injuries were consistent with</p>	<p>1 CERTIFICATE OF COURT REPORTER</p> <p>2 I, Catherine M. White, C.S.R. and Notary</p> <p>3 Public, Hinds County, Mississippi, do hereby certify:</p> <p>4 That on the 23rd day of November, 2010, there</p> <p>5 appeared before me, pursuant to notice and the Federal</p> <p>6 Rules of Civil Procedure, Dr. Steven Hayne as a witness</p> <p>7 in the above-mentioned cause;</p> <p>8 That said witness was duly sworn by me to tell</p> <p>9 the whole truth, and nothing but the truth in said</p> <p>10 cause;</p> <p>11 That counsel appeared on behalf of the</p> <p>12 respective parties as hereinbefore set forth;</p> <p>13 That the foregoing deposition was taken by me</p> <p>14 by means of Stenograph machine and translated into</p> <p>15 transcript form by me, and that the foregoing 38 pages</p> <p>16 contain a full, true and correct transcription of the</p> <p>17 testimony of said witness;</p> <p>18 That I am not in any way associated with any of</p> <p>19 the parties to said cause of action, or their counsel,</p> <p>20 and that I am not interested in the event hereof.</p> <p>21 IN WITNESS WHEREOF, I have hereunto set my hand</p> <p>22 this the 29th day of November, 2010.</p> <p>23</p> <p>24 Catherine M. White</p> <p>25 CSR No. 1309</p> <p>My Commission expires: 2/1/2014</p>
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<p>1 an object being inserted or penetration?</p> <p>2 MR. JICKA: Object to the form.</p> <p>3 A. Yes, they were consistent with that.</p> <p>4 MR. McNAMARA: That's all I have.</p> <p>5 MR. JICKA: Just one second. Let's go off</p> <p>6 the record.</p> <p>7 MR. MAGEE: Off the record. The time is</p> <p>8 9:53.</p> <p>9 (Recess.)</p> <p>10 MR. MAGEE: This concludes the deposition.</p> <p>11 The time is 9:56.</p> <p>12 (Whereupon the deposition was concluded at</p> <p>13 9:56 a.m., the same day.)</p> <p>14</p> <p>15</p> <p>16</p> <p>17</p> <p>18</p> <p>19</p> <p>20</p> <p>21</p> <p>22</p> <p>23</p> <p>24</p> <p>25</p>	

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Deposition of Dr. Steven Hayne

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Anthropomorphic simulations of falls, shakes, and inflicted impacts in infants

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Object. Rotational loading conditions have been shown to produce subdural hemorrhage and diffuse axonal injury. No experimental data are available with which to compare the rotational response of the head of an infant during accidental and inflicted head injuries. The authors sought to compare rotational deceleration sustained by the head among free falls, from different heights onto different surfaces, with those sustained during shaking and inflicted impact.

Methods. An anthropomorphic surrogate of a 1.5-month-old human infant was constructed and used to simulate falls from 0.3 m (1 ft), 0.9 m (3 ft), and 1.5 m (5 ft), as well as vigorous shaking and inflicted head impact. During falls, the surrogate experienced occipital contact against a concrete surface, carpet pad, or foam mattress. For shakes, investigators repeatedly shook the surrogate in an anteroposterior plane; inflicted impact was defined as the terminal portion of a vigorous shake, in which the surrogate's occiput made contact with a rigid or padded surface. Rotational velocity was recorded directly and the maximum (peak-peak) change in angular velocity ($\Delta\dot{\theta}_{max}$) and the peak angular acceleration ($\ddot{\theta}_{max}$) were calculated.

Analysis of variance revealed significant increases in the $\Delta\dot{\theta}_{max}$ and $\ddot{\theta}_{max}$ associated with falls onto harder surfaces and from higher heights. During inflicted impacts against rigid surfaces, the $\Delta\dot{\theta}_{max}$ and $\ddot{\theta}_{max}$ were significantly greater than those measured under all other conditions.

Conclusions. Vigorous shakes of this infant model produced rotational responses similar to those resulting from minor falls, but inflicted impacts produced responses that were significantly higher than even a 1.5-m fall onto concrete. Because larger accelerations are associated with an increasing likelihood of injury, the findings indicate that inflicted impacts against hard surfaces are more likely to be associated with inertial brain injuries than falls from a height less than 1.5 m or from shaking.

KEY WORDS • brain injury • child abuse • diffuse axonal injury •
subdural hematoma • children

TRAUMATIC brain injury is the most common cause of death in children.³ Brain injuries resulting in hospitalization or death occur in at least 150,000 children per year, at a rate of more than 200 per 100,000 children. Head injury in infancy results in higher incidences of morbidity and mortality than those seen in older children, and it has become increasingly clear that the significant incidence of nonaccidental injury in the youngest patients is, in large part, responsible for this difference.^{5,11,28,29}

The majority of serious traumatic brain injuries in infants and toddlers is due to child abuse, and abused children with brain injury have a worse outcome than children who sustain an accidental brain injury.^{5,13} The actual mechanism of injury responsible for subdural hemorrhage, retinal hemorrhage, axonal injury, and skeletal trauma that characterize abusive head injury has been debated for decades. Caffey^{6,7} first proposed the term "whiplash shaken infant syndrome" to describe the occurrence of subdural and retinal hemor-

rhages in response to presumed inflicted angular acceleration of the head. Others have followed with reports of subdural hemorrhage, retinal hemorrhage, and death occurring in the absence of contact injury (skull fracture, cranial bruising, or scalp swelling).^{2,20} Regardless, contact head trauma remains a frequent finding in abusive head injury.¹⁷

Accidental falls are also a common cause of trauma found in the pediatric population, with falls accounting for 25 to 34% of hospital admissions for pediatric trauma and 6% of deaths in children due to trauma.^{21,34} Nevertheless, accidental falls are a common history given by caregivers in suspected abuse cases. The suspicion of abuse often arises when the event history appears not to correspond to the injury in the child. The differentiation between causes of accidental and abusive head injury is hindered by the controversy regarding fall heights associated with serious head injuries in children. Evidence exists to support the hypothesis that short falls do not cause serious injury and the critical height for a fall to cause death is substantial (> 10 ft).^{4,10,34,36,49,55} Simultaneously, however, others contend that relatively short falls can occasionally cause injuries associated with high mortality rates, such as SDHs, epidural hematomas, and skull fractures.^{3,18,19,21,40,43,44,46,54} Because the mechanical responses experienced by the head and the in-

Abbreviations used in this paper: ANOVA = analysis of variance; DAI = diffuse axonal injury; SDH = subdural hematoma; TAI = traumatic axonal injury; Δt = duration of the maximum change in angular velocity; $\Delta\dot{\theta}_{max}$ = maximum (peak-peak) change in angular velocity; $\ddot{\theta}_{max}$ = peak angular acceleration.



TABLE 1
Comparison between body measurements in infant and surrogate

Body Measurement	Infant	Surrogate
head weight (kg)	0.77–0.87*	1.13
head circumference (transverse plane [cm])	39.5†	40.5
head height (inferior to superior [cm])	13.5†	12.6
head breadth (right to left [cm])	10.5†	11.4
head length (anterior to posterior [cm])	14.1†	12.6
distance from shoulder to top of head (cm)	14.7†	15.1
distance from axis of rotation (C5–6) to top of head (cm)	15.4‡	14.7
distance from axis of rotation (C5–6) to center of gravity of the head (cm)	9.5‡	9.2
distance from axis of rotation (C5–6) to base of skull (cm)	3.3*	4.5
distance from axis of rotation (C5–6) to transducers (cm)	not applicable	18.0
total body weight (kg)	3–4* 4.8§	4.83
breadth of shoulders (cm)	17.6†	17.8
head/body weight ratio	0.23* 0.24	0.23

* Weight of 1-month-old infant according to Duhaime, et al., 1987.

† Measurements obtained in an infant 0 to 3 months of age according to Schneider, et al.

‡ Distance according to Swishchuk.

§ Weight of average male or female 6-week-old infant according to Kuczmarski, et al.

|| Ratio in a 6-week-old infant according to Jensen.

jury tolerances associated with shaking, shaking with impact, and falls have not yet been established, the differentiation between accidental and inflicted head injury is problematic. Objective information regarding these parameters is needed to determine if some circumstances are more hazardous than others during accidental and inflicted traumatic situations.

Previously, dolls that were anthropomorphically matched to human infants were shaken with and without impact;¹² investigators reported that during an inflicted impact the angular deceleration of the head is 45 times that observed during a vigorous shake, exceeding scaled thresholds for concussion, subdural hemorrhage, and DAI. In that study, however, the angular (rotational) motions were calculated on the assumption that there was a fixed center of rotation, and were not measured directly. Moreover, falls were not simulated, only inflicted shakes and impacts. In this study, we have created an improved anthropomorphic surrogate of a 1.5-month-old infant, and directly measured the rotational velocities experienced by the head of the surrogate during shakes, inflicted impacts, and short-distance falls. This research also extends that of previously published studies by examining the effect of different contact surfaces on the rotational response of the infant's head during both abusive and accidental injury scenarios. By comparing the responses, our findings are an important step toward distinguishing the potential for head injuries caused by rotational motion during contact and purely inertial events, and during accidental and inflicted injury scenarios.

Materials and Methods

Construction of the Anthropomorphic Dummy of an Infant

Head Design. A dummy was designed, constructed, modified, and

improved to create a more biofidelic and durable anthropomorphic surrogate of a 1.5-month-old infant than that used previously. The head of a toy doll (Lil' Baby; JC Toys Group, Inc., Miami, FL) was used to represent the head of the anatomically correct 1.5-month-old anthropomorphic surrogate. Because the center of gravity and the majority of an infant's body mass are located in the head and torso, the distribution of the weight of the arms and legs of the infant were incorporated into the weight of the torso. The surrogate's total body weight, 4.8 kg (10.6 lb), was matched to that of a 1.5-month-old infant whose body weight lies within the 50th percentile.²⁵ Using previously reported measurements, the distributed masses of the head and body were adjusted to mimic those of 1.5-month-old infant by creating a head/total body weight ratio of 0.235^{22,23} (1.13-kg head mass). The breadth, length, and width of the head were measured and are in good agreement with those obtained in a 0- to 3-month-old infant in the 50th percentile (Table 1).

Neck Design. One-month-old infants have very compliant necks with little muscle tone and control of head movement.⁹ The weak flexor and extensor muscles of the neck allow a significant lag between the head and torso when raising the infant to a sitting position and lowering him or her back to a lying position.⁹ The normal movement of the neck has been described in the context of qualitative neurological examinations and developmental assessments in children; however, no quantitative information is available on the biomechanics of the human infant neck. In light of the absence of detailed quantitative information about the kinematics of infant necks in the literature, we fashioned a hinged neck with negligible resistance for the dummy, as previously published.¹³ In this way, measurements would reflect a worst-case scenario of no resistance provided by the neck, so that we could ascertain the greatest possible velocities and accelerations that can be generated by these mechanisms. One end of a heavy-duty stainless-steel strap hinge was rigidly attached to the skull material on the surrogate's head; the other end was rigidly attached to the torso. The hinge was used as the neck joint in the surrogate to allow resistance-free motion in extension and flexion with no movement in other directions. The center of rotation of the hinge was located 9.2 cm inferior to the center of the mass of the head, and corresponded to the junction between C-5 and C-6 measured by magnetic resonance imaging.³¹ Although the fixed center of rotation in the dummy would result in an overestimation of rotational acceleration because the actual centers of rotation are likely to be higher in the cervical spine, the relatively short cervical spine, compared with the head size of a typical young infant, minimizes the influence of this idealization. Regardless, this simplification once again errs on the side of a worst-case scenario.

Skull and Scalp Material. Another design consideration was the representation of the stiff skull with a flexible scalp. Experiments were performed to determine appropriate "skull" and "scalp" materials to use in the construction of the dummy. The mechanical properties of the orthopedic-grade copolymer polypropylene (2.25 mm thick; American Plastics, Fort Worth, TX) were tested and determined to lie between those of infant skull and suture.^{31,32} The plastic was heated and molded to the head of the surrogate and allowed to cool to room temperature. The instrumentation mounting bracket was attached securely to the skull, creating a rigid connection among the instrumentation, surrogate skull material, and head. A latex rubber material (Mold Builder [1.25 mm thick]; ETI, Fields Landing, CA) with properties similar to scalp^{33,34} was used to cover the occipital portion of the polypropylene skull; this material remained adherent throughout the tests.

Head Instrumentation

An angular rate sensor (model ARS-01; ATA Sensors, Albuquerque, NM) was securely attached to the top of the dummy's head via a lightweight bracket, and was adjusted to measure rotations with an axis of rotation oriented perpendicular to the sagittal plane. This transducer location was selected to be remote from the impact site, so as not to damage the transducer in the impact and fall experiments. Any similar location on the head and transducer orientation would have yielded the same rotational velocity data. The velocity channel was sampled at 10,000 scans per second and filtered using a digital Butterworth low-pass filter (DADiSP/2000; DSP Develop-

Anthropomorphic simulations

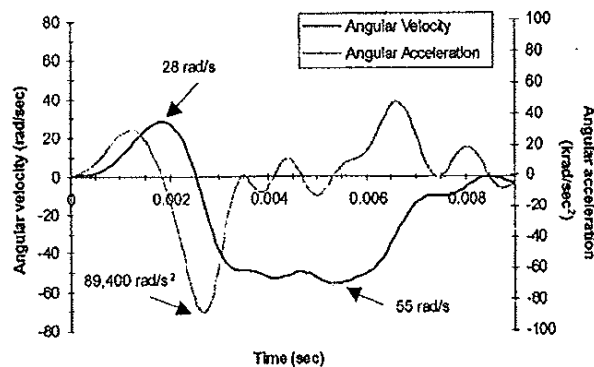


FIG. 1. Graph showing a representative angular velocity and acceleration trace for the impact produced from a 0.9-m (3-ft) fall onto concrete.

ment Corp., Newton, MA) as specified by the Society of Automotive Engineers.³⁰ Simulations of falls and inflicted impacts that involved contacting hard materials (carpet pad, concrete, or lab bench) were processed through a low-pass filter with a cutoff frequency of 1000 Hz, according to the standard SAE J211-1 channel frequency Class 1000 used for measuring head accelerations during automotive crash tests.³⁰ Because shakes and impacts against the foam mattress had pulse durations much longer than impacts against hard surfaces, these signals were processed through a low-pass filter with a cutoff frequency of 250 Hz to eliminate the noise from the velocity signal.

Abuse and Accident Reconstruction

A custom-designed drop-test apparatus was constructed to allow the dummy to be dropped consistently from 0.3-m (1-ft), 0.9-m (3-ft), and 1.5-m (5-ft) heights. The surrogate was suspended supine from three points (two on the body, one on the head) with the height of the dummy's head placed slightly lower (< 3 cm) than the body to ensure that the surrogate's occiput was the first point to contact the surface. To reproduce the shaking of an infant, the surrogate was grasped firmly by its torso and held at chest level. The dummy was then shaken back and forth, making sure that during each shake the head went through a complete range of motion from full extension to full flexion. Each episode included at least five shakes, with the final shake concluding with an inflicted impact of the surrogate's occiput against one of three materials located at approximately the volunteer's waist level (0.9 m from floor). The sequence was divided into two segments, the "shaking event" and the "inflicted impact event," for analysis. Volunteers were instructed to use maximum effort during vigorous shaking and impact, and not to release or throw the dummy during impact.

Three materials were used in the fall and inflicted impact simulations: a piece of 10.2-cm (4-in)-thick foam from a crib mattress, a section of 6.35-mm (0.25-in)-thick carpet pad, and a hard surface (concrete floor for falls, stone bench top for inflicted impacts). These materials were tested and the average linear elastic moduli of the foam and carpet pad were measured and found to be 24.8 and 621 kPa, respectively,³² whereas the elastic modulus of concrete in compression has been documented to range from approximately 20 to 60 GPa.⁴¹ These data demonstrate the wide range of contact surface characteristics that were used in the household fall situations.

Statistical Analysis

After filtering the measured angular velocity for each event, angular acceleration was calculated by taking the derivative of the angular velocity-time history trace. Only the rotation caused by the initial impact was analyzed in traces for falls and inflicted impacts. For each shaking event, only the shake with the greatest angular acceleration was analyzed out of the series of shakes in the episode. Each event was analyzed to find the $\Delta\theta_{\max}$, the Δt , and the $\dot{\theta}_{\max}$ during this interval.

A total of 134 fall events were reconstructed from various heights

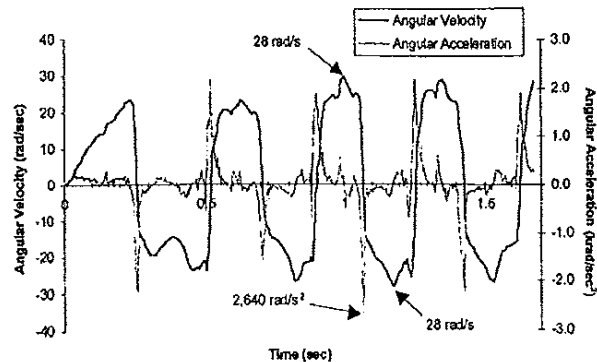


FIG. 2. Graph showing a representative angular velocity and acceleration trace for a shaking event.

onto different surfaces with at least 14 falls for each height-surface combination. A representative trace of the measured angular velocity and calculated angular acceleration during a fall is shown in Fig. 1.

Sixty-one shaking and impact sequences were performed by six different adult volunteers (four male and two female volunteers ranging in weight from 50–100 kg). Nearly all shaking episodes (60 of 61) consisted of a shake and an inflicted impact segment in which the surrogate's occiput made contact with one of three surfaces (foam in 18 episodes, carpet pad in 20 episodes, and a composite bench top in 22 episodes). Typical angular velocity and angular acceleration measurements from a series of shakes and inflicted impacts are shown in Figs. 2 and 3, respectively.

To determine overall differences between falls from different heights and onto different surfaces, three separate two-way ANOVAs were used to analyze the $\Delta\theta_{\max}$, $\dot{\theta}_{\max}$, and Δt individually. A Tukey test for multiple comparisons was also performed to determine the differences between each individual type of fall. The measurements from shakes were compared with inflicted impacts against different surfaces by using one-way ANOVA to determine the significance of the test mode and the Tukey test to determine differences between each pair of test modes. A Dunnett test for multiple comparisons to a control was used to compare the $\Delta\theta_{\max}$, $\dot{\theta}_{\max}$, and Δt from all falls, comparing the effects of the various surface materials by using shakes as the control or standard in the Dunnett test. The same analysis was repeated in a sequence of Dunnett tests by using inflicted impacts against foam, carpet pad, or bench top as the control group in each evaluation. Statistical significance was defined at a probability value of 0.05 or less for each analysis.

Results

Falls Onto Padded and Unpadded Surfaces

A two-way ANOVA revealed a significant overall increase in $\Delta\theta_{\max}$ and $\dot{\theta}_{\max}$ ($p < 0.001$; Fig. 4 upper and center) and a decrease in Δt with falls onto harder surfaces and from greater heights ($p < 0.001$; Fig. 4 lower). A Tukey test revealed no significant effect of the height of the fall in the measured $\Delta\theta_{\max}$ or $\dot{\theta}_{\max}$ during falls onto foam and showed that both kinematic measurements at a given height were significantly less for falls onto foam than for those onto carpet pad or concrete. Falls from a given height onto the carpet pad and concrete were indistinguishable, except for the $\dot{\theta}_{\max}$ during 1.5-m falls. For a particular surface, no significant difference between 0.9- and 1.5-m falls was found in the measurements of $\Delta\theta_{\max}$ or $\dot{\theta}_{\max}$; however, measurements of Δt were significantly different when comparing fall heights onto foam, with the Δt decreasing as the height of the fall increased.

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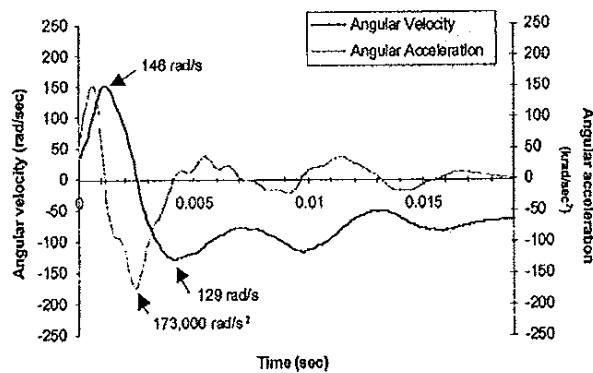


FIG. 3. Graph demonstrating representative angular velocity and acceleration trace for an inflicted impact against a bench top.

Shakes and Inflicted Impacts

Averaged across volunteers, the values of $\Delta\dot{\theta}_{\max}$ and $\dot{\theta}_{\max}$ during inflicted impacts against foam were greater than, although not significantly different from, those measured during shaking events (Fig. 5 upper and center). Inflicted impacts against foam, however, had a significantly shorter average Δt than shaking events (Fig. 5 lower). Inflicted impacts against the carpet pad and rigid bench surface were indistinguishable. Taken together, inflicted impacts against these two hard surfaces resulted in an approximately 39 times greater $\dot{\theta}_{\max}$, a three times greater $\Delta\dot{\theta}_{\max}$, and a 53 times shorter Δt than the response measured during shaking.

Shakes had a statistically similar $\Delta\dot{\theta}_{\max}$ to those of 0.3-m falls onto concrete and carpet pad, and a similar $\dot{\theta}_{\max}$ to that of falls onto a foam mattress. Shaking resulted in a significantly longer Δt than any fall events. Inflicted impacts against foam had a similar $\dot{\theta}_{\max}$ to that of falls onto a foam mattress and a similar $\Delta\dot{\theta}_{\max}$ to that of falls onto concrete. Inflicted impacts against a hard surface resulted in a similar Δt to those of falls onto carpet pad and concrete, and had a significantly greater $\Delta\dot{\theta}_{\max}$ and $\dot{\theta}_{\max}$ than all fall scenarios.

Discussion

The focus of this study was to determine the rotational response of the head of an infant that is experienced during low-height falls and inflicted head injuries. Rotational motions have been shown to cause a diffuse pattern of strains and injury throughout the brain, whereas translational motion causes more focal damage.³⁷ For this reason, with the exception of epidural hematoma, falls have often been considered benign, because they are assumed to be essentially translational events. Nevertheless, although a fall may have predominantly translational components, its terminus (contact with an often immobile object) may produce significant rotational events and the brain may also experience rapid changes in rotational velocity and deceleration. It was the purpose of this study to measure these rotational events and to compare them with those created by shaking, impacts after free falls, and inflicted impacts.

In the impacts against carpet pad and concrete simulated in this study, the occiput made contact before the torso and then rotated, producing a significant angular motion of the

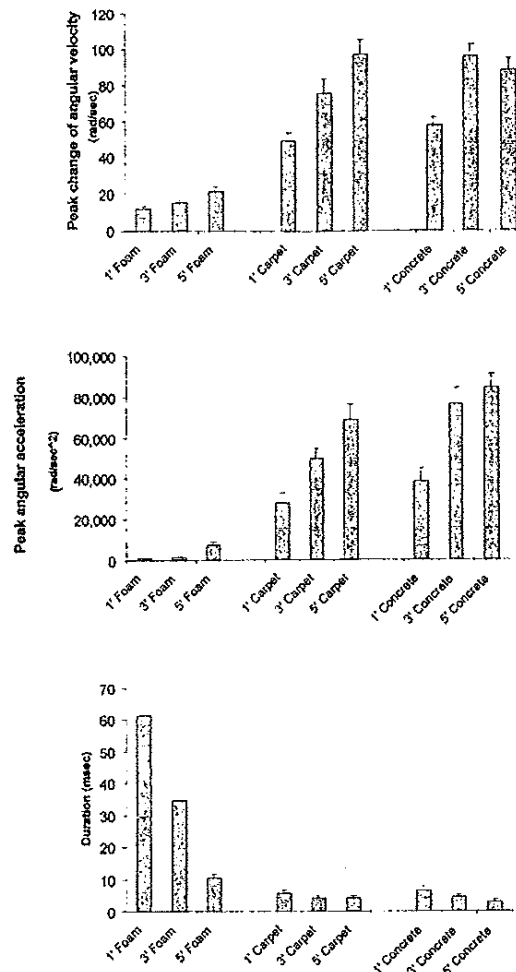


FIG. 4. Bar graphs showing the $\Delta\dot{\theta}_{\max}$ (upper), $\dot{\theta}_{\max}$ (center), and Δt (lower) for falls from different heights onto different surfaces. The bars depict mean values and the error bars indicate standard errors.

head relative to the thorax. We found that the rotational accelerations and changes in rotational velocity experienced by the head during impact increased with the height of the fall. These larger rotational responses can be attributed to the higher linear velocities reached as drop height (and thus potential energy) increases. Harder surfaces absorb less energy than deformable materials during contact, causing the head to rebound more; the head thus experienced significantly larger rotational accelerations during contact with the concrete and the carpet pad, compared with contact with foam, during falls and inflicted impacts. Conversely, when the head contacted the foam it was pocketed in the foam, such that both torso and head moved together, producing only a very small rotational response. It should be emphasized that the foam material used in these tests was uncased, and the addition of a plastic or other covering might alter the deceleration pattern. For this reason, one cannot extrapolate tests performed using uncased foam to impacts against a covered mattress or padded furniture.

Anthropomorphic simulations

Head rotations during shakes occurred over significantly longer time periods than any other event. Thus, although shakes had a similar $\Delta\theta_{\max}$ to that of a 0.3-m (1-ft) fall onto concrete and carpet pad, this change in velocity occurred over a much longer period, producing a significantly lower $\dot{\theta}_{\max}$. Furthermore, shakes had a similar $\dot{\theta}_{\max}$ to that of falls onto the mattress foam, but because the Δt is longer, shakes had significantly higher $\Delta\theta_{\max}$ values.

There has been much debate on whether shaking alone is sufficient to cause the typical primary brain injuries seen in inflicted neurotrauma in infancy, specifically, SDH and/or TAI, or whether impact is necessary. Recent evidence suggests that injury to the cervicomedullary junction may be found in some cases of fatal inflicted head injury, and the role of this finding in the pathophysiology of apnea, hypoxia, and secondary cellular events is, at present, incompletely understood. Regardless, the focus of this study was to investigate the biomechanical causes of primary brain injuries by using rotational forces as a benchmark for the incidence of acute intracranial events such as failure of parasagittal bridging veins or axonal tears. To mimic inflicted impacts, the shaking scenarios described earlier were concluded with an impact of the surrogate's occiput against one of three surfaces. Our results demonstrate that measurements made during inflicted impacts against a carpet pad were not significantly different from those made during impacts against a rigid surface (lab bench top). Although the pad was less stiff than the bench top, the carpet pad used was only 6.35 mm (0.25 in) thick and the force of the inflicted impact completely compressed the pad during impact. During impact the carpet pad therefore exhibited the same properties as the underlying bench top during the later stages of contact. Inflicted impacts against carpet pad and bench top produced a significantly greater $\Delta\theta_{\max}$ and $\dot{\theta}_{\max}$ than those experienced under all other conditions simulated in this study. In contrast, the inflicted impact against the thicker (10-cm) foam mattress did not fully compress the foam, resulting in a $\Delta\theta_{\max}$ and $\dot{\theta}_{\max}$ that were lower than those associated with inflicted impacts against harder surfaces and similar to those associated with shaking. To summarize, inflicted impacts against the carpet pad and bench top had a three times greater $\Delta\theta_{\max}$ and a 39 times greater $\dot{\theta}_{\max}$ than shaking. These results suggest a higher likelihood of injury from inflicted impacts against hard surfaces than from vigorous shaking, or from falls of 1.5 m or less.

Sixteen years ago, we published results found using a less sophisticated anthropomorphic dummy of a 1-month-old infant,¹² and found similar $\Delta\theta_{\max}$ and $\dot{\theta}_{\max}$ ratios between shakes and impacts to those in the current study. In the current study, we constructed a more biofidelic 1.5-month-old dummy by using skull and scalp material with properties similar to those in infants. We measured rotational velocity directly and expanded the study to include falls and a wide variety of contact materials. Despite these improvements, the current study has several limitations. The dummy designed for this study included a simplified representation of the infant skull and neck that potentially influenced loads during falls and impact events. First, the dummy's skull was made from a solid homogeneous 2.25-mm-thick sheet of copolymer polypropylene. The actual braincase of an infant consists of bone plates connected by compliant sutures that allow substantial deformation of the skull. The compliant skull deforms during the birthing process and permits nor-

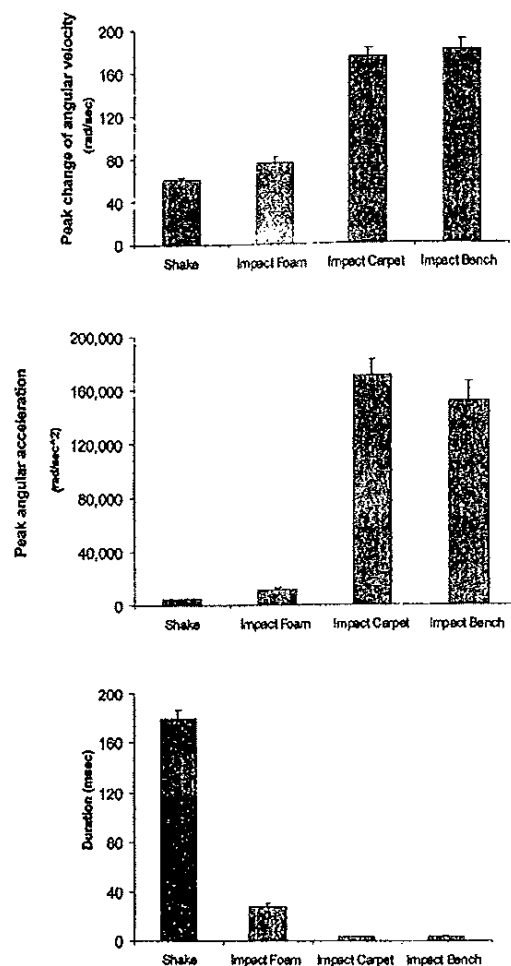


FIG. 5. Bar graphs showing the inflicted $\Delta\theta_{\max}$ (upper), $\dot{\theta}_{\max}$ (center), and Δt (lower) for shakes and impacts against different surfaces.

mal expansion of the brain and soft tissues during infancy and childhood; it also allows large changes in shape during impact loading.³¹ These skull deformations would slow the period of contact during an impact, and decrease the resulting angular accelerations. The solid plastic "skull" of the dummy is therefore not an exact representation of the separate bone and suture material of an infant, and it could cause an overestimate of the response measured during impact events. Studies including more accurate skull and suture representations, which can also be used to measure skull contact forces, are now underway; the important data obtained in these studies will be crucial for computational simulations of skull and brain injuries caused by these focal loads experienced during impacts.

A second limitation of the current study is the inability of the surrogate's neck to mimic the properties of a real infant's neck. At present, no detailed quantitative information is available to validate the biomechanical properties of the human infant neck. However, as a child matures, the neck stiffness increases, offering more resistance to a rotational motion of the head relative to the torso. Nevertheless,

young infants (< 2 months old) have little muscle tone in their necks and cannot support the weight of their heads.⁹ Thus, the low-resistance hinge representation may be appropriate for a newborn but not an older child. Furthermore, the cervical spine consists of a series of vertebrae, allowing for rotation of the neck in different locations and directions; the hinge used to model the neck motion in the dummy has a fixed point of rotation, only allowing anteroposterior flexion and extension. The hinge does not provide resistance to motion or dampen responses between the torso and neck. More accurate kinematics of the infant neck would allow for translation as well as rotation of the head, and a moving center of rotation. These differences in the kinematics of the neck result in an overestimation of the rotational motions experienced during falls and inflicted events. Although the biofidelity of the surrogate has not been established, these experiments do provide an upper boundary for the measured head response to shaking, inflicted impact, and falls. When data are available on properties of the neck, a more biofidelic model should be created to ensure accurate measurements during inflicted and accidental injury scenarios.

A third limitation of the study is that the model represents a child in the 50th percentile for body and head mass. A heavier child with the same neck development would experience higher impact energy in a fall or inflicted impact due to the larger mass, and likely would experience a concomitant larger rotational velocity and acceleration than a smaller child. It is difficult to speculate, however, whether the volunteers could have generated the same peak acceleration with a heavier child. Considering that each sequence was a maximum effort, it is likely that the shakes would have resulted in a lower acceleration and velocity in a heavier dummy. Thus we would anticipate a greater disparity among the data obtained during shakes, impacts, and falls with increasing body and head mass.

Subdural hematoma and TAI are among the most common findings in serious head injuries in infancy and in those associated with nonaccidental causes. Both these injury types have been produced by, and correlated to, the angular velocity or angular acceleration of the head.^{1,15,16,32} Rotational motions have been shown to cause a diffuse pattern of strains and injury throughout the brain, whereas translational (linear) motion causes more focal damage.^{24,37} Although the anthropomorphic dummy test data are useful to evaluate the rotational response of the head caused by falls and inflicted injury events, the results of the dummy tests cannot be used to predict whether such rotations are sufficient to cause injury. Regional tissue thresholds specific to the infant would be required to predict injury on the basis of local intracranial stresses or strains produced by the rapid rotations. Such thresholds are currently unavailable for the pediatric population. In lieu of this information, we used a more qualitative approach to determine injuries likely to occur during simulated events. Specifically, we correlated measured accelerations and changes in velocity with injuries documented from controlled cadaver, animal, and human experiments in which the response is often measured directly and the exact details of the injury event are carefully recorded. Using dimensional analysis, angular velocities and accelerations from the different animal, human, and cadaver experiments were scaled to the infant as a function of brain mass (420 g).³⁸ These results were compared with the different rotational responses measured in the minor fall

and inflicted impact events simulated in the dummy experiments performed in this study.

Impacts from falls from 0.3, 0.9, and 1.5 m onto mattress foam, and from 0.3 m (1 ft) onto carpet pad produced the lowest rotational accelerations and changes in velocity of all falls examined in this study. Weber³⁴ found only a 10% chance of skull fracture when infant cadavers were dropped from a similar height onto a similar surface. No data have been collected from animal and human experiments that were conducted at the low levels of $\dot{\theta}_{max}$ and $\Delta\dot{\theta}_{max}$ measured during falls onto foam. Values of $\dot{\theta}_{max}$ and $\Delta\dot{\theta}_{max}$ similar to those measured during 0.3-m falls onto carpet pad were recorded from head rotations of instrumented models of boxers with no occurrence of concussion, skull fracture, SDH, or TAI of the brain.³⁹ All cases of SDH and DAI in human cadaver studies and primate (rhesus monkey and baboon) rotational inertial experiments^{1,15,32} had considerably greater angular accelerations and velocities when scaled to a human infant than an average $\dot{\theta}_{max}$ and $\Delta\dot{\theta}_{max}$ produced by falls onto foam. Correlating these experimental data, it is highly unlikely that serious or fatal injuries occur during falls onto an unencased foam mattress from a height of 1.5 m or less, or from 0.3 m falls onto a carpet pad.

At the rotational responses calculated during impacts after 0.3-m (1-ft) falls onto concrete and 0.9-m (3-ft) falls onto carpet pad, it is not clear if serious injuries occur. The experimental evidence shows both the absence and occurrence of serious head trauma. Specifically, although human infant cadaver drop test studies have demonstrated an 80 to 100% occurrence of skull fractures,^{44,53} subhuman primate inertial studies^{1,15,32} and adult cadaver studies³⁵ have shown both the presence and absence of intracranial hemorrhage and acute SDH.

No experimental data could be found with a $\dot{\theta}_{max}$ and $\Delta\dot{\theta}_{max}$ similar to those of the most severe falls, that is, 1.5-m (5-ft) and 0.9-m (3-ft) falls onto concrete and 1.5 m (5 ft) falls onto carpet pad. At lower values of $\dot{\theta}_{max}$, however, impacts to the cadaver head caused intracranial bleeding, and nonhuman primates experienced SDH and DAI. The absence of data at this highest tier underscores our uncertainty regarding the occurrence of serious injury at these levels. These falls represent an extreme limit, producing the maximum rotation because of the hinge neck, the occipital contact site, and the purely sagittal rotation. In reality a fall is likely to include mixed rotational directions that would decrease the actual acceleration in the sagittal plane and the potential for SDH. For these idealized situations of falls onto hard surfaces, experimental data thus support at least the possibility of intracranial injuries caused by these most severe falls measured in this study.

There were no experimental data at values of $\dot{\theta}_{max}$ and $\Delta\dot{\theta}_{max}$ similar to those measured during shaking or inflicted impacts against foam. For example, shakes and inflicted impacts against foam each had a $\Delta\dot{\theta}_{max}$ similar to that associated with noninjurious head rotation in boxers,³⁹ but these human tests produced a significantly greater $\dot{\theta}_{max}$. The most severe inflicted impact against foam approached, but was still less than, the values of $\Delta\dot{\theta}_{max}$ and $\dot{\theta}_{max}$ that produced SDH in adult rhesus monkeys and cadavers.^{1,15,32} To summarize, there are no data demonstrating that the $\Delta\dot{\theta}_{max}$ and $\dot{\theta}_{max}$ experienced during shaking and inflicted impact against foam cause SDH or TAI in infants.

Anthropomorphic simulations

Finally, although the $\dot{\Theta}_{\max}$ and $\Delta\dot{\Theta}_{\max}$ measured during inflicted impacts against carpet pad and rigid bench top were significantly greater than those associated with all other scenarios tested in this study, no animal, human, or cadaver experiments at these levels of $\dot{\Theta}_{\max}$ have been published. The majority of inflicted impacts against these hard surfaces produced a $\Delta\dot{\Theta}_{\max}$ and $\dot{\Theta}_{\max}$ greater than the scaled rotational responses that produced fatal acute SDH in adult primates and intracranial bleeding in adult cadavers.^{1,15,33} Approximately half of these inflicted impacts also exceeded the scaled $\Delta\dot{\Theta}_{\max}$ and $\dot{\Theta}_{\max}$ that produced axonal injury in adult baboons.³² Given this experimental data, angular velocities and accelerations measured during inflicted impacts against hard surfaces would likely produce SDH and, possibly, TAI in an infant.

These injury projections should be interpreted with caution, because differences in species, age, material properties, geometry, and direction make scaling experimental angular acceleration and velocity measurements to infants problematic when based on differences in brain mass alone. To avoid the limitations of using scaled loads from animal and cadaver experiments to investigate real life events, case studies of minor falls in infants were also used to examine injuries that occur as a result of falling from different heights. Unfortunately, these falls are rarely witnessed, load measurements of the event are lacking, contact surface information is rarely given, and the population studied generally includes a broad age range, rather than just newborns. To increase the specificity of our comparisons, we included only case studies of children reported to be younger than 3 years old.

Skull fracture has been reported as a result of minor falls in children younger than 3 years.^{11,18,19,23,27,47,52,55} Reports of falls 0.6 m or less note an absence of skull fracture.^{44,48,53,55} Studies have documented cases of skull fracture from minor falls from heights estimated to be 0.9 m (3 ft)^{18,19,47,52} and 1.2 to 1.5 m (4–5 ft)⁵⁵ with no fatalities. Importantly, several studies have also shown an increase in the risk of skull fracture with the increased hardness of surfaces contacted after a free fall.^{27,54} To summarize, these case study data provide evidence that minor falls (< 1.5 m) can cause skull fracture, especially if the impact occurs on a hard surface.

Case studies of infants younger than 3 years old have shown that SDH, TAI, and death are rarely caused by impact from falls from 1.5 m (5 ft) or less. In a 3.5-year retrospective study, Chadwick and colleagues⁸ found no fatalities resulting from 1.5- to 2.75-m (5–9-ft) falls. In that study the authors did find three to seven deaths in children younger than 3 years of age with a history of falling from approximately 0.6 to 1.2 m (2–4 ft), but the majority of these cases had associated injuries attributed to abuse. Cases of playground falls reported by Plunkett⁴⁰ revealed only six fatal falls ranging from 0.6 to 1.8 m during an 11.5-year period. The causes of death in all six children were determined to be SDH or cerebral edema. Studies of falls occurring in hospitals from an estimated height of 0.61 to 1.2 m (2–4 ft) do not show any case of SDH or death.^{22,30,36} Other case studies have shown no incidence of SDH or death caused by falls from 0.9 m (3 ft).^{48,55} To our knowledge, no case study contains a report of serious brain injuries or death caused by falls from 0.3 m (1 ft) or less. Similar to the results of the animal and cadaver experimental data, these

data show that, although the possibility exists, SDH and death from minor falls are unlikely.

Conclusions

This paper presents the rotational response of the head of an infant, measured using an anthropomorphic dummy, during minor falls, shakes, and inflicted impacts. In general, the $\dot{\Theta}_{\max}$ and $\Delta\dot{\Theta}_{\max}$ increased with increasing fall height and surface hardness. The measured angular velocity and acceleration during minor falls were similar to those associated with shaking; however, inflicted impacts against hard surfaces produced a significantly greater $\dot{\Theta}_{\max}$ and $\Delta\dot{\Theta}_{\max}$ than a 1.5-m fall onto concrete. Because larger rotational acceleration and velocities are associated with a higher likelihood of injury, these findings suggest that inflicted impacts against hard surfaces may be more frequently associated with clinically significant inertial brain injuries than vigorous shaking or falls from less than 1.5 m. In addition, there are no data showing that the $\Delta\dot{\Theta}_{\max}$ and $\dot{\Theta}_{\max}$ of the head experienced during shaking and inflicted impact against unencased foam is sufficient to cause SDHs or primary TAIs in an infant.

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